RAILROAD GAZETTE

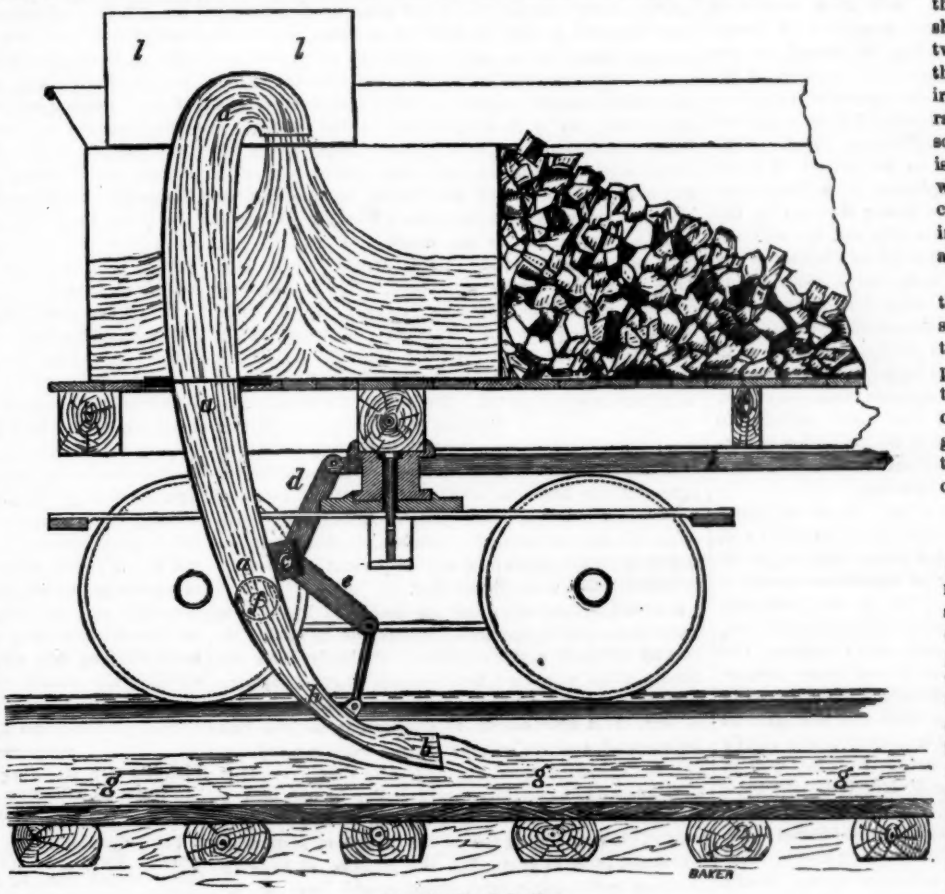
A JOURNAL OF TRANSPORTATION.

VOL. XIV.—NO. 23. FIRST QUARTO VOLUME. | CHICAGO, SATURDAY, SEPTEMBER 3, 1870. | $3 per Annum IN ADVANCE.

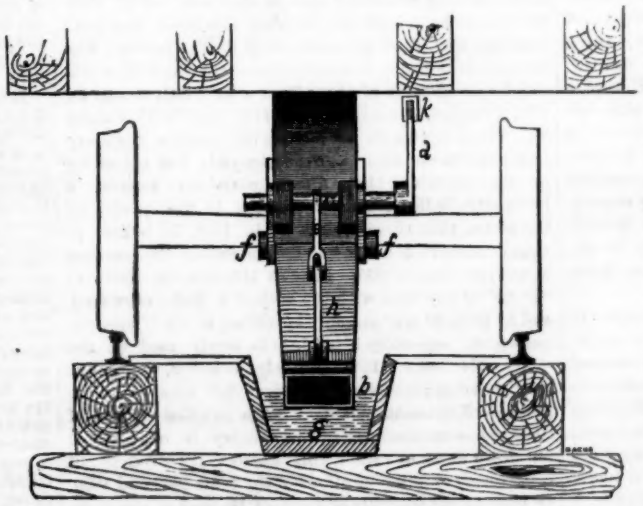
"JERK WATER" FOR FILLING LOCOMOTIVE TANKS.

The competition between the through lines to New York has led the managers of these roads to study every means by which the running time may be shortened, or the speed increased. The New York Central, having a longer line between Chicago and New York than the Pennsylvania Railroad, were of course at considerable disadvantage in competing with the latter in making the time with their fast trains. The managers of the Hudson River road, in order to save running time, have adopted the arrangement for taking up water without stopping which we illustrate in the cut, and which has been described in a number of journals, but is represented for the first time by "graphic art" in the RAILROAD GAZETTE.

The arrangement is very simple, and consists of a trough *g, g, g,* about 600 ft. long, which is placed between the rails on a level portion of the track. A sort of scoop, *h*, is attached to the tender and has a joint, *f*, by which it can be raised or lowered into the trough. The latter is partially filled with water, and the scoop dips into it about two inches deep. The water is forced into the mouth of the scoop, *b*, and up the pipe *a, a, a,* into the tank by the motion of the tender. The quantity of water which can be taken up in this way is amazing. An engine with this attachment will run at the rate of thirty miles per hour over one of the water troughs, and in much less time than it takes to write this sentence, and in very little more than is required to read it, will drop its "proboscis" and pick up a thousand or twelve hundred gallons of water. It of course requires a great deal of care to drop the "scoop" the precise time when the engine comes to the trough and raise it as soon as the tank is filled. The scoop is raised and lowered by a lever, which is not shown in the cut. Just before the train comes to the trough the fireman unfastens the lever, and is prepared to drop the scoop *h* into the water at the right moment. Its motion through the water raises a wave in front of it, so that, although the mouth, which is five inches high and ten inches wide, dips below the surface only two inches, it is entirely filled with water by the wave. At high speeds the resistance is so great against the scoop that it requires all the strength of a man to raise it out of the water. A long incline is placed at each end of the trough, so that in case of a failure to raise the scoop at the right moment as little damage as possible would be done. As soon as the scoop is dropped into the water, a sort of rushing sound is heard, and before you realize what is going on, the fireman with a powerful jerk at the lever, lifts the scoop, and the tank is filled. Some care must be exercised not to leave the scoop in the trough too long, as the volume of water taken is so great that in an instant it will deluge the whole tender.



Longitudinal Section.



Transverse Section.

An arrangement very similar to the one we have described has been used in England for the same purpose, but to Mr. Buchanan, the Superintendent of Machinery of the Hudson River Railroad is due the credit of having, by practical experiment, perfected and adapted the idea to the requirements of the traffic of his road. To adapt a new idea to a specific purpose often requires greater knowledge, and certainly more experience, than to originate the idea itself. In the practical difficulties to be overcome usually consists the difference between success and failure. Mr. Buchanan found that when the mouth of the scoop was flared or spread laterally, much more water was wasted or thrown out of the trough than if the sides of the scoop were left parallel; and also that more water was carried into the tank by contracting the neck of the scoop than if the same sectional area was retained all the way up.

The scoop below the joint is made of sheet copper, and the pipe *a, a, a,* above the joint, is cast iron; *c* is a shaft with two arms, *d* and *e*, the latter connected by a link to the scoop; *k* is a rod which connects the upper arm to the lever by which the scoop is raised and lowered, and which is not shown in the cut; *l, l,* is a hood over the pipe to prevent the water being thrown out of the tank.

The rails are laid on longitudinal timbers, 12x12 inches, so as to give height enough between them for the water trough. The one shown in the cut is made of two-inch plank, but another in the same road is made of sheet-iron. The track between the rails where the trough is laid is sodded so as to prevent dust. It is thought that in winter the water could, without much difficulty, be prevented from freezing by running a steam pipe along the bottom of the trough.

It has been suggested, too, that by the arrangement described, water could be supplied to cattle which are being transported in railroads if suitable troughs were furnished to the cars. We recommend the suggestion to cattle dealers and to the "Society for the Prevention of Cruelty to Animals."

—The lucubrations of the daily press on engineering and mechanical subjects, although sometimes amusing, not unfrequently point out some real public want. Both of these were the case with a recent article in the New York *World*, concerning the annoyance of flying dust and cinders experienced in passenger railway-cars. The writer said that the discomfort to travelers from that source is, "at any rate serious enough to make the question of relief worthy of close consideration," which is very true. He also intimates that in the age of perfection a water-car may be "furnished with copious sprinklers to lay the dust along the way," which is rather funny. When, however, he asks "Why do not our inventors turn their attention to the subject?" he ignores what scores of projectors have attempted, and many of them successfully accomplished—the devising of means whereby air, cool and free from dust from the track or cinder from the smoke-stack, can be supplied to the interior of the cars.

A pipe opening at the front end of a car will allow the air to enter through it in a current having a velocity equal to the speed of the train, and there is no more skill needed in fitting a pipe in this manner than in putting a cowl on a common chimney. To cause the air current to pass through water, so that its suspended dust and cinder particles may be washed away, would require nothing but an application of the well-known principle by which gases are made to pass from the mouth of a chemist's retort to a receiver through the water of a pneumatic trough. To conduct and distribute the air thus purified, and, if the temperature of the water were sufficiently low, also cooled by its contact with the latter, to the interior of the car, would necessitate only a very simple arrangement of tubes or pipes. Here, then, we have the essentials for dispensing with one of our greatest annoyances; but that they will be found in common use for many a day to come we do not believe.—*Am. Artisan.*

Contributions.

THE LOCOMOTIVE PRACTICALLY CONSIDERED.

Boiler Explosions.

BY WM. S. HUNTINGTON.

Engineers are gradually losing their faith in mysterious, unaccountable and unnatural causes of boiler explosions, and are far more willing to believe that such accidents are the results of natural causes than they were years ago. There are, however, even in this enlightened age, many engineers who entertain superstitious notions in regard to the cause of boiler explosions, and a certain class of them firmly believe that these disasters frequently occur from unnatural causes and cannot be prevented by any human agency. At least so it appears from decisions in many cases of explosions; but perhaps it is a matter of policy on some occasions to charge the cause of the explosion to some *mysterious agent*, and if all these charges are correct the *mysterious agent* must have a great deal to answer for. If an engineer survives an explosion, he will as a matter of course, use every effort to relieve himself of all blame; and if from any feelings of delicacy, he should be unwilling to charge the blame upon the builder of the boiler or any other person whose reputation might be injured thereby, it is very convenient for all concerned to have it charged to the "mysterious agent." The above remarks have reference to all classes of steam boilers, but in case of the explosion of a locomotive boiler, next to the engineer, the Master Mechanic is the person most interrested professionally and he will not willingly acknowledge the fault as his own or that of any person under his charge; and so the "mysterious agent" must bear the blame. It is true that boiler explosions sometimes occur under circumstances that puzzle disinterested experts in arriving at a decided conclusion as to the cause, and they, rather than injure their professional reputatation by hazarding an opinion that they fear would not be accepted as the true cause, manage to befog the minds of lesser lights in the profession by attempted explanations of mysterious causes, and thus leave the matter in doubt and darkness.

But the days of the "mysterious" agent are numbered, and henceforth the explosion of a steam boiler will, with few exceptions, be regarded as the result of purely natural causes. The frequency of disastrous explosions is, to some, a matter of surprise; but to those who are familiar with the treatment that boilers too often receive, it is a wonder that they are not more frequent. The monthly reports of the Hartford Steam Boiler Inspection and Insurance Company are working much good in creating a general reform in the care and management of steam boilers. Although their operations are chiefly among stationary boilers, those who have the care of the locomotive boilers may profit largely by the hints thrown out by their inspectors.

There are now in operation in the United States about 16,000 locomotives, and the boilers of many of these have been in use a long time and have become unsafe, although they may appear perfectly sound. The great number of boilers that explode under moderate pressure when no outward signs of weakness are exhibited is a strong support to the theory that decomposed steam, electricity, explosive gases, etc., are the causes. Recent decisions prove that in most cases of explosions under these circumstances the cause may be attributed to deterioration from age. It seems that about fifteen years' service is all that a boiler can bear with safety with good usage, although there are many now in use that have seen service for a much longer period and are considered safe. It is the opinion of some English engineers that a boiler should never be used more than fifteen years under any circumstances, but the experience of those who have written on the subject has been mainly with boilers in the mines and collieries where they were exceedingly liable to injury from corrosion, incrustation, etc.

The usage of a locomotive boiler is more favorable to long life than that of any other class, and there seems to be no reason why they should not be able to withstand the action of time for several years longer than boilers set in damp arches. There is no doubt but that the treatment a boiler receives, the nature of the water used, etc., has much to do with the length of time it may serve with safety. As to locomotive boilers, the habit many engineers have of blowing off at too high pressure, is perhaps the most injurious of any usage to which they are subjected. The sudden contraction and expansion caused by blowing out a hot boiler and immediately refilling with cold water is ruinous and will in time bring a boiler to grief. Another mischievous practice with many engineers is placing weights of old iron, such as pieces of broken chairs, or even whole ones, broken links, etc., on the safety-valve lever, when working a heavy train up a sharp grade. This recklessness is practiced to a greater extent than many suppose and is the means by which some engineers manage to get over the road with a few cars more than any one else. These old irons are removed before coming to headquarters, where "the old man" would notice it; and the engineer through fool hardiness has carried a point. In this matter, however, the engineers are not alone to blame; for so long as a premium is offered to the man who will take the heaviest trains over the road, there are plenty who will take the chance of any manner of risk rather than be outdone. In this manner, for the mere gratification of a foolish and reckless ambition, many valuable lives have been lost and much property destroyed, and the "mysterious agent" is again wrongfully accused. So long as this practice is permitted boiler explosions will increase and become more frequent, and although some States have enacted laws making it a punishable offence to work steam boilers at excessive pressure, they do not seem to be carried into effect. To ascertain the injurious effect on boilers of water highly charged with mineral substance, some leading roads have had the water along the line subjected to chemical analysis in order to ascertain, if possible, to what extent boilers were injured by the presence of certain substances and in what length of time they would be rendered unsafe by its use. This matter is of vital importance, as it is well known that the strength of boiler iron becomes impaired by use without giving any visible signs of weakness, such as incrustation, corrosion, &c. would produce, but the entire substance of the plates on many occasions have been found weakened to such an extent as to be unable to sustain one half the pressure that they would when new. They have undergone a change, or, to use the common expression, become "rotten." If it could be ascertained to a certainty to what extent this change is due to the presence of certain substances in the water used, no doubt the number of explosions would be greatly reduced. But it does not appear that experimenters in this direction thus far have arrived at any reliable conclusions; but they claim to have discovered that the water in some sections of the country is comparatively harmless, while that in other localities has a serious effect on boiler plates. More light is needed on this subject, and as the field is an inviting one, we may reasonably expect new and important discoveries in this direction at no distant day.

It would be interesting and profitable to know how many of the 16,000 locomotive boilers now in use in this country are in an unsafe condition. Probably there are hundreds that would not bear one-half as great pressure as when new, and yet they are to all appearance as safe as ever. If it were known to what extent the iron had deteriorated, and the causes thereof, no doubt many disastrous explosions would be prevented thereby. If it were known to a certainty that a boiler would bear a pressure of 200 pounds to the inch, and it were properly treated, it would be as safe as one capable of sustaining a pressure twice as great; but the practice of hanging old irons on the safety-valve lever would have to be abandoned or it would be "a game of perhaps." Fifteen years ago there were about 5,500 locomotives in use in the United States, and many of these were at that time of uncertain age; but if fifteen years is, as has been asserted, as long as a boiler can be used with safety, then there must be at least that number (less those that have gone the way of all the earth) unfit for further use. The increase in mileage of road for the next year, 1856, would call for an addition of about 70 new locomotives, and for 1857 a further increase of about 112, and for 1858 about 80. These figures do not include the number necessary to replace those that were destroyed; but according to the doctrine that fifteen years' use renders a locomotive boiler unsafe by changes in the quality of the plates, then there would be in 1871 70 boilers in round numbers unfit for use, not including the number in use previous to 1855. In 1872 112 will be liable to "go up" at any time with the help of a little crowding, and in 1873, 80 may possibly be visited by the "mysterious agent" especially if old iron is freely used on the safety valve lever. It is not likely, however, that either year above mentioned will witness that number of explosions of locomotive boilers, as the greatest number of these disasters occurring in this country in one year is put down at 34, or rather this number occurred in 12 consecutive months—portions of the years 1865 and 1866. In reading the accounts of most of these explosions one is surprised at the great number that but *recently undergone thorough repairs*. These *thorough repairs* seem to be fatal to the safety of steam boilers, and on many occasions this is the real cause of the trouble. Patched boilers are unsafe, and instead of making a boiler stronger, patching has a tendency to weaken it, as will be apparent to any one on a little reflection. The practice of putting patch upon patch is a dangerous one, and when a boiler comes to patching it should be replaced by a new one. An engineer would naturally have confidence in the strength and safety of a boiler which had just been *thoroughly repaired*, and if he through confidence and the desire to excel in the performance of his engine unconsciously allows steam to get beyond a safe pressure and an explosion is the result in which he loses his life (which is too often the case). a true verdict would be "Died of thorough repairs." Many an innocent and well meaning engineer has lost his life and the lives of others through the desire of a master mechanic to keep a boiler in use as long as possible for motives of economy. There are many master mechanics deserving of censure, in fact deserving of punishment, for the course they pursue in allowing engines to be run day after day and month after month whose boilers are known to be unsafe, for no other reason than to save a few dollars for the company. So long as this responsible position is filled by men of this kind we can have but little hope that boiler explosions will become less frequent, as any discoveries of the cause of these terrible destroyers of life and property and the means whereby they may be prevented are of little avail when the saving of a paltry sum is regarded as of more importance than the safety of human life. A locomotive boiler is not necessarily such a dangerous affair as many regard it, and if thoroughly made, of good material, and well used, with a due regard to safety, we would seldom hear of a boiler explosion. We have frequent proof of the truth of this—in fact the circumstances attending almost every boiler explosion when thoroughly understood point unmistakeably to the fact that it was the result of natural causes and might have been prevented by the exercise of proper care on the part of those in charge of it or those who are responsible for its usage.

It is demonstrated that other parts of locomotives are deteriorated by long continued use and become unsafe when external appearances would give no evidence of the fact. Wheels and axles often give way after long continued use at times when they are not subjected to more strain than they have withstood for years with no apparent diminution of strength, the size at the point of fracture not being diminished sufficiently to cause breakage. Although the breaking of driving axles in this country is not a frequent occurrence as compared to the breakage of other axles, such as tender and car axles, yet it is of sufficient importance to demand the attention of master mechanics, as the breaking of a driving axle is usually attended with serious results. Any improvement in the process of manufacturing material for these axles whereby they may be rendered capable of withstanding the strains of percussion and tortion will be eagerly sought after.

TO BE CONTINUED.

Liability for Building Burned by a Fire Caught from Locomotive Sparks Does not Extend to Buildings Adjoining.

The judgment of the Common Pleas of Huntingdon County, Pa., has recently been reversed in the Supreme Court of that State, in a case between the Pennsylvania Railroad Company and one Kerr. A warehouse, situated near defendant's track, had been ignited by sparks emitted from a negligently placed locomotive of the defendants'; the burning warehouse in turn communicated fire to the plaintiff's building, distant some thirty-nine feet, destroying it. It was held that the proximate cause of the plaintiff's loss was the burning warehouse; that the defendants' negligence was but the remote cause; and therefore the defendants were not liable to the plaintiff. The opinion of Judge Thompson, July 8, 1870, was as below:

It has always been a matter of difficulty to judicially determine the precise point at which pecuniary accountability for the consequence of wrongful or injurious acts is to cease. No rule has been sufficiently defined and general to control in all cases. Yet there is a principle applicable to most cases of injury which amounts to a limitation. It is embodied in the common law maxim, *causa proxima, non remota spectatur*—the immediate and not the remote cause is to be considered. Pars. on Cont., Vol. III., p. 198, illustrates the rule aptly by the suppositive case of debtor and creditor, as follows: "A creditor's debtor has failed to meet his engagements to pay him a sum of money, by reason of which the creditor has failed to meet *his* engagement, and the latter is thrown into bankruptcy and ruined. The result is plainly traceable to the failure of the former to pay as he agreed. Yet the law only requires him to pay his debt with interest. He is not held for consequences which he had no direct hand in producing and no reason to expect. The *immediate* cause of the creditor's bankruptcy was his failure to *pay his own debt*. The cause of that cause was the failure of the debtor to pay him, but this was a remote cause, being thrown back by the interposition of the proximate cause, the non-payment by the creditor of his own debt." This I regard as a fair illustration of the words, "*proxima*" and "*remota*." See also Notes, same volume, p. 180.

In Harrison v. Berkley, 1 Strobh. (S. Car. Rep.) 548, Mr. Justice Wardlaw indulges in some reflections on this point worth referring to in this connection. "Every incident," says he, "will, when carefully examined, be

found to be the result of combined causes; to be itself one of various causes, which produces other events. Accident or design may disturb the ordinary action of causes. It is easy to imagine some acts of trivial misconduct or slight negligence, which shall do no direct harm, but sets in motion some second agent that shall move a third, and so until the most disastrous consequences shall ensue. The first wrong doer, unfortunate, rather than seriously blameable, cannot be made answerable for all these consequences."

It is certain that in almost every considerable disaster, the result of human agency and dereliction of duty, a train of consequences generally ensues, and so ramifies, as more or less to affect the whole community. Indemnity cannot reach all these results, although parties suffer who are innocent of blame. This is one of the vicissitudes of organized society. Every one in it takes the risk of these vicissitudes. Wilfulness itself cannot be reached by the civil arm of the law, for all the consequences of consequences, and some sufferers necessarily remain without compensation. The case of Scott *vs.* Shepherd, 2 Wm. Blac. R. 893, the case of the squib, is sometimes cited as extending the principle of the maxim, but it is not so. The doctrine of proximate and remote causes was really not discussed in that case. One threw a squib in the market place among the crowd. It fell on the stall of one who immediately cast it off to prevent it exploding, there, and it struck a third person and exploded, putting out his eye. The question was, whether the defendant could be made answerable in the form of action adopted, which was trespass. Chief Justice De Grey held that the first thrower, the defendant, was answerable, for that in fact the squib did the injury by the first impulse. In this way the action of trespass was sustained. It is no authority against the principle suggested. There must be a limit somewhere. Greenl. in vol. II., p. 256, touches the question thus: "the damages to be recovered must be the natural and proximate consequence of the act complained of." This is undoubtedly the rule. The difficulty is in distinguishing what is proximate and what remote. I regard the illustration from Parsons already given, although the wrong supposed arises *ex contractu*, as clear as any that can be suggested. It is an occurrence undoubtedly frequent that by the careless use of matches houses are set on fire. One adjoining is fired by the first, a third is by the second, and so on, it might be for the length of a square or more. It is not in our experience that the first owner is liable to answer for all these consequences and there is a good reason for it. The second and third houses, in the case supposed, were not burned by the direct action of the match, and who knows how many agencies might have contributed to produce the result. Therefore it would be illogical to hold the match chargeable as the cause of what it did not do, and might not have done. The text books, and I think the authorities, agree that such circumstances define the word "*remota*" removed, and not the immediate cause. This is also Webster's third definition of the word remote. The question which gives force to the objection that the second or third result of the first cause is remote, as put by Parsons, Vol. II., 180, "did the cause alleged produce its effects without another cause intervening, or was it made to operate through or by means of this intervening cause?" There might possibly be cases in which the causes of disaster, although seemingly removed from the original cause, are still incapable of distinct separation from it, and the rule suggested might be inapplicable; but of these when they occur. The maxim, however, is not to be controlled by time or distance, but by the succession of events.

The case on hand is a claim against the defendant under these circumstances, briefly: A ware-house of one Simpson, situated very near the track of the company's road, was set on fire by sparks emitted from a locomotive engine of the defendants, so negligently placed as to set it on fire. The burning of the warehouse communicated fire to a hotel building situated some thirty-nine feet from the warehouse, which, at the time, was occupied by the plaintiff as tenant, and it was consumed, with its furniture, stock of liquors and provisions, and for this the plaintiff sued and recovered below. Several other disconnected buildings were burned at the same time, but this is in no way, involved in this case. No doubt the company was answerable for the destruction of the warehouse, resulting from the negligence of the company's servants in the use of engine. The authority to the company to use steam on their road does not exempt it from liability for injury resulting from the negligent use of it: Lackawanna & Bloomsburg R. R. C. v. Doak, 2 P. F. Smith, 379. The learned judge charged that the defendant was liable to the plaintiff to the extent of his loss, by reason of the burning of the hotel, although by fire communicated from the warehouse, if the latter was set on fire by the negligence of the defendants' servants, in the manner mentioned. To this charge the defendants excepted, and assign it for error, and this presents the question of this case.

This charge was of course the equivalent of holding, that a recovery for all the consequences of the first act of negligence of the defendants, was in law allowable. We are inclined to think in this there was an error, for the reasons already given, and others that will be given. It cannot be denied but that the plaintiff's property was destroyed, but by a secondary cause, namely, the burning of the warehouse. The sparks from the locomotive did not ignite the hotel. They fired the warehouse and the warehouse fired the hotel. They were the remote cause —the cause of the cause of the hotel being burned. As there was an intermediate agent, or cause of destruction, between the sparks and the destruction of the hotel, it is obvious that that was the proximate cause of its destruction, and the negligent emission of sparks the remote cause. To hold that the act of negligence which destroyed the warehouse, destroyed the hotel, is to disregard the order of sequences entirely, and would hold good if a row of buildings a mile long had been destroyed. The cause of destruction of the last in that case, would be no more remote, within the meaning of the maxim, than that of the first, and yet how many concurring elements of destruction there might be in all of these houses, and no doubt would be, no one can tell. So to hold, would confound all legitimate ideas of cause and effect, and really expunge from the law the maxim quoted, that teaches accountability for the natural and necessary consequences of a wrongful act, and which should in reason, be only such that the wrong-doer may be presumed to have known would flow from his act. According to the principle asserted, a spark from a steamboat on the Delaware, might occasion the destruction of a whole square, although it never touched but a single separate structure. No one would be likely to have the least idea of such accountability, so as to govern and control his acts accordingly. A railroad terminating in the city, might, by the slightest omission on the part of one of its numerous servants, be made to account for squares burned, the consequence of a spark communicating to a single building. Were this the understanding of the extent of liability under such circumstances, it seems to me that there might be more desirable objects to invest capital in, than in the stock of such a railroad. But it never has been so understood or adjudged. Lowrie, J., in Morrison v. Davis & Co., 8 Har. 171, illustrates the argument against such liability most strikingly by reference to a well known fact. In the case he was treating, a horse in a canal boat team was lame, in consequence of which the boat was behind time in reaching the Juniata river, and in consequence of that was overtaken by a flood in the river which destroyed the boat with its freight. The carrier, the owner of the boat, was charged with being negligent in using a lame horse the occasion of the delay. In treating of this as only the remote cause of the disaster, the learned Judge said: "There are often very small faults which are the occasion of the most serious and distressing consequences. Thus, a momentary act of carelessness set fire to a little straw, and that set fire to a house, and by an extraordinary occurrence of very dry weather and high winds, with this little fault, one-third of a city (Pittsburgh) was destroyed; would it be right that this small act of carelessness should be charged with the whole value of the property consumed?" The answer would and ought to be: No, it was but the remote cause of it. Innumerable occasions must have occurred in this commonwealth for asserting liability to the extent and upon the principle claimed here, yet we have not a solitary precedent of the kind in our books. This is worth something as proof against the alleged principle. It was Littleton's rule, "that what never was, never ought to be:" 1 Vern. 385.

The question in hand has not been adjudicated in this State, and but seldom discussed in any of the other States; yet we have a case decided in the Court of Appeals in the State of New York, in 1866, which is directly in point in support of the doctrine we have been endeavoring to advance above. It is the case of Ryan *vs.* The New York Central Railroad Co., (8 Tiffany,) 35 N. Y. 210. The facts in that case briefly were, that the defendant, by the carelessness of its servants, or through the insufficient condition of some of its locomotive engines, set fire to its own woodshed with a large quantity of wood therein. The plaintiff's house, situated some 130 feet from the shed, took fire from the heat and sparks of the burning shed and wood, and was entirely consumed. A number of other houses and buildings were destroyed by the spreading of the fire. The plaintiff brought suit against the company for his loss. On the presentation of these facts at the trial, the Circuit Judge nonsuited the plaintiff, and at the general term of the Supreme Court of the Fifth District the judgment was affirmed. The case was then removed to the Court of Appeals, where the judgment was unanimously affirmed in an elaborate and exhaustive opinion by Hunt, J. Every position taken by the counsel for the defendant in error here was taken there, and examined and answered fully in the opinion. All the English and American cases supposed to have any bearing on the point in dispute there on the same question we have here, are noticed by him, and the doctrine clearly deduced, that the railroad company was not answerable to the plaintiff for the loss of his house being burned by fire communicated by the burning shed. That case is not distinguishable in principle, or in the manner of destruction, from this. It is on all fours with this case.

But it seems to have been thought that the Insurance Co. v. Tweed 7 Wal. (U. S. Rep.) 45 conflicts with the above case. I do not think it does when understood. It was an action on a policy of insurance against fire, in which there was an exception of several matters, namely, invasion, insurrection, military and usurped power, *explosion*, earthquakes &c. An explosion took place in a warehouse on the opposite side of the street from the insured property, and scattered fire and burning fragments upon the insured property and destroyed it. The decision of the Supreme Court was that the loss was within the exception of the loss by fire occasioned by explosion. To me it seems that it would have been rather more rational to have held that the destruction was by fire *per se*. But the Court interpreted the terms of the contract of the parties in this way. We must remember that there may be a difference between interpreting the obligation of a contract, and defining liability under the laws of social duty. Certain it is the laws are not the same. One does not necessarily rule the other. I may say further that there is no evidence, in the opinion of Mr. Justice Miller, that he had specially in view the same question, so ably discussed by Mr. Justice Hunt, or if he had, that his investigations extended so far as did those of the last named Judge. He does not even refer to the New York case at all.

The question here involved does not seem to have been definitely determined in England; why, I am at a loss to know. There have been decisions, it is true, imposing liability against the reasons we have expressed above, but in none of them is the question of the proximate and remote cause of the inquiry discussed at all. Such is the case in Pigot v. The Eastern Counties R. R. Co. 54 Eng. C. L. Rep. 229, cited by the council for the defendant in error; and such is the recent case of Smith v. The London and Southwestern R. R. Co., Law Rep. March 1870, p. 98. In this case, Boville, C. J., and Keating, J., affirmed the recovery. Brett, J., dissented. Both these cases were before the Court of Common Pleas. I find no review of the question in the Exchequer Chamber. I regard these cases as passing over the question that was decided in the Court of Appeals in New York, and which is before us now, *sub silentio*. Hunt, J., expresses, to some extent, my experience, when he says, "I have examined the authorities cited from the Year Books, and have not overlooked the English Statutes on the subject, or the English decisions, extending back for many years. It will not be useful further to refer to the authorities, for it will be impossible to reconcile some of them with the views I have taken." I entirely agree, that if they shed any light, it is too uncertain and dim to be followed with safety; while, on the other hand, the concurrence of principle, with a just measure of responsibility, is best subserved, we think, by the rule we suggest. With every desire to compensate for loss when the loser is not to blame, we know it cannot be without transcending the boundaries of reason, and, of course, law. This we cannot do, and we fear we would be doing it if we affirmed the judgment in this case. The limit of responsibility must be somewhere, and we think we find it in the principle stated. If not found there it exists nowhere. We have not been referred to any case, in any of the States and courts, excepting those noticed, and I have not myself discovered any which in the least militates against the foregoing views; we are therefore constrained to follow the result of our conclusions, and reverse the judgment in this case. At present we will not order a *venire de novo*, but if the plaintiff below and defendant in error desire, we will order it on grounds shown for it, if made in a reasonable time.—*Legal Intelligencer.*

Workshops of Manchester, England.

Forty-five years ago, at the commencement of the writer's career as a mechanic, tools were of a very rude and primitive description, the lathe and drill being about the only ones then in general use; slide lathes were possessed only by a few persons, being made with great labor and expense, and very inferior in point of workmanship.

The introduction of the planing machine, however, and its subsequent development, effected an entire change in the manufacture of tools and machinery of every class, giving the means of carrying out with facility many works which had been left unattempted previously as too expensive or impracticable, and opening the way for improvements and invention generally; and in a short time these machines became indispensable in every workshop. The slide lathe became then comparatively easy of manufacture, and, in conjunction with the planing machine and self-acting drill, formed a most important feature in the advancement of engineering work. Still, much remained to be effected; a large proportion of work was done by hand, especially the smaller portions of machinery, until slotting and shaping machines were brought into use, and special tools adapted for all parts where quantity of work was required to be produced. By the gradual introduction and perfecting of the regulator screw, the wheel cutting engine, standard gauges, large surface plates, long straight edges, and scraped surfaces, combined with the improved tools, not only was the amount of manual labor considerably diminished, but the work was done more expeditiously, and a much greater degree of accuracy was attained, whereby the workmanship in all classes of machinery was remarkably improven, and at a great reduction in cost.

Another important feature in connection with improved tools, is the direct application of steam power to individual machines, especially those for the purpose of punching or shearing plates or cutting bars, etc., by the combination of a small steam engine with each machine, thus rendering the machines portable, entirely self-contained, and independent of other sources of driving power, and thereby saving, in many instances, the necessity of running a large engine and quantity of shafting to drive only one or two machines when pressed for the work upon which they are engaged, and entirely dispensing with shafting and the usual attendant expenses. By this means, and by the use of an underground steam pipe with branches at convenient points, either in workshops or along the sides of docks, these machines may be moved about to any part required, and thus obviate the inconvenience and loss of time in carrying work to and from the machines. Steam pipes of great length are now being used, and are found very satisfactory for purposes of this description; and this plan makes a much more convenient and less costly arrangement than shafting, which requires constant attention.

In the earlier construction of the lathe, the slide rest was the first great step toward the principle of the slide lathe, and no doubt led to that invention, which was considered impracticable before planing machines were made of sufficient magnitude to plane a lathe bed of even small dimensions. A few slide lathes had indeed been made, the bed of which was composed of a timber framing, covered with iron plates on the upper side to preserve the surface, similar to those which were previously used for the ordinary hand lathes, with the exception that the outer edges of the iron edges of the iron plates were made of suitable shape to form the Vs for the carriage to slide upon. It was not, however, until some time after the introduction of the planing machine that (the cost of workmanship being considerably lessened) slide lathes came into general use, and their utility was generally acknowledged, and attention directed to their improvement.

The application of a screw to the slide lathe, so as to render it capable of both sliding and screw-cutting, was the next important improvement; and a great amount of time, perseverance and capital was expended by a

few persons in endeavoring to perfect this portion of the lathe. A short screw was first made, as accurately as possible with the rude means then possessed, from which one was cut double the length, by changing the turned bar end for end in the lathe after cutting one-half. Subsequently, by following out this principle, screws were capable of being made of any length required.

After this, the surface motion was introduced, and also the use of a shaft at the back of the lathe, in addition to the regular screw, for driving the sliding motion by rack and pinion, instead of both the motions of sliding and screw cutting being worked by the screw alone; for it was found that the threads of that portion of the screw nearest the fast head stock, being most in use, were worn thinner than the other parts; and, in consequence, the lathe did not cut a long screw with the degree of accuracy which it otherwise would have done.

Thus, step by step, improvements were gradually brought forward; the fore jaw and universal chucks, and other important appliances were added, so as to render the lathe applicable to a great variety of work, even cutting the spiral grooves in shafts, scrolls in lace-plate, skew wheels, and also turning articles of oval, spherical, or other forms. The duplex lathe, with one tool acting in front, and the other behind the work, is also found to be a very useful arrangement for turning long shafts, cast-iron rollers, cylinders, and a great variety of work, where a quantity of the same kind and dimensions has to be turned.

The planing machine is one of the most important tools in use, and has done more toward the advancement and success of engineering work than any other invention, with the exception of the lathe, and has passed through a great number of changes since its first introduction down to the present time. In the first planing machines the table was moved by a chain winding on a drum, as in the old hand machines; this was found to be very objectionable, the cut was unsteady, and, when the tool was suddenly relieved at the end of its cut, the table had a tendency to spring forward; it was also driven at the same speed both forward and backward, and thus a great loss of time was occasioned. This was much improved upon by the use of a rack and pinion, arranged to give a quick return motion, and also afterward by the screw arrangement.

In some of the earliest planing machines the Vs were made inverted, evidently with the idea of preventing any cuttings that fell upon the wearing surfaces from remaining upon them. They proved, however, to possess no advantage even in this particular, as the finer portions of the cuttings still adhered; and in addition it was found that, from the motion of the table, the oil, by its own gravity, would not remain upon the surfaces, and thus caused them to cut and wear away quickly.

The writer has in use a planing machine, with a bed 54 feet long, the Vs of which have two inches of surface on each side, and are planted to an angle of 85 degrees. This machine has been working upward of twenty years, and for the last six years both night and day. It has been employed during the whole of that time on very heavy work, ranging from 5 to 20 tons. The Vs are still in good condition, apparently very little worn, and the work the machine does is at the present time perfectly true. The bed is in three parts joined and bolted together, and the table in two parts, since, at the time it was made, there was no machine capable of planing a very long piece, and this was considered to be one of the largest then in existence.

The planing machines were further improved by the use of two tool-boxes on the cross-slide, and by the application of slide rests or tool-boxes fixed upon the uprights, self-acting vertically, for planting articles at right angles to the tools on the cross-slide. The reversing tool-box is a very ingenious and useful contrivance for planing flat surfaces; but that plan is not so well adapted for general purposes. Planing machines have, like other tools, been specially adapted to a great variety of work, and the writer has made them with different numbers of tools, up to as many as sixteen, all of which were in operation at once.

The great changes which have lately taken place in the manufacture of wrought iron and steel ordnance, and the revolution they have caused in the construction of vessels of war, have called into requisition a great many alterations and adaptations of the present machines, as well as many entirely new ones. The planing machine, especially, has been called upon to do work of a very curious and intricate character, namely, that of planing the edges of armor plates to different curves, shapes, or angles. In most cases, this had been accomplished by a pattern bar of iron or steel, placed on edge in a small chuck fixed upon the surface of the table, adjustible by set screws, and shaped to the form to which it is required to plane the edge of the plate; as the table travels, this bar, which runs between two circular rollers attached to the under side of the cross-slide, moves the tool sideways according to the amount of curve in the shaper or guide bar, the tool-box being disconnected for this purpose from the screw in the cross-slide.

A duplex planing machine, made by the writer, is arranged with double beds and double tables, each table having a separate set of gearing, with starting, stopping and feed motion. There are two tool boxes at the cross-slide, each of which is independently self-acting, so as to work with its own table. Thus the two tables may be used separately, as two smaller machines working independently of each other, and capable of planing different lengths of work at the same time; or when planing a large article, the two tables, gearing and motion, may be coupled, so as to form one large machine, an arrangement rendering the machine capable of doing a large variety of work. Also one table may be fixed stationary as a bed-plate to bolt awkwardly shaped or long pieces of work upon, while they are planed by a slide rest fixed upon the other table. When used as one machine, both sets of straps and gearing are in operation, and are reversed by the stops of one table only, so as to increase the straps moving at the same time.

This machine is capable of planing articles 10 feet wide and 10 feet high. The racks on the under sides of the table are 3 inches pitch, with stepped teeth; the wheel working into the rack is 3 feet 9 inches diameter at the pitch line, and is driven by a smaller pinion. By this arrangement a steadier motion is obtained; and also the pulleys and driving gear can be placed entirely behind the face of the uprights, so as to leave the front of the machine perfectly clear, that the straps may not be in the way when taking the work off and on. The pulleys being below the ground line, may be driven by a horizontal underground shaft at the back of the machine, and no straps will then be visible. The writer has made machines of this description with beds 40 feet long, to plane work up to 14 feet in width.—*Newton's London Journal.*

On Steam Boiler Inspection.*

Steam boilers are now so common, and so often seen working with apparent safety on steamboats, or railways, or in manufactories, that familiarity is apt to breed contempt for the danger that surrounds them if they should be faulty or used without due care.

The wreck produced by the explosion of a steam boiler is often so extensive that the casual observer is easily persuaded that there must have been some sudden accession of power at the moment of explosion, and is readily made to believe in mysterious theories involving intricate suppositions as to the influence of electricity, the spheroidal condition of water in contact with hot plates, the decomposition of water and ignition of the gases, the sudden generation of steam from water heated to a high temperature, and a host of other phenomena which are themselves true and perfectly understood, but have little or nothing to do with boiler explosions.

A very simple calculation will enable anyone to realize that there is plenty of "force" accumulated in an ordinary boiler to account for all the mischief, if it is liberated suddenly. A boiler of an average size contains when at work sufficient accumulated "force," in the shape of steam and heated water, to work a 30-horse engine for about 10 minutes without additional firing, and if this should be liberated in one second by the rupture of the boiler, the power to cause explosion is equal to the united effort of 18,000 horses. A boiler forms a reservoir of power, and, like a reservoir of water, is capable of producing much useful work if allowed to flow gradually through a proper mill or engine, but capable of vast destruction should the rupture of the sides allow the contents to escape suddenly.

It has been calculated that the explosive effect of each cubic foot of water in a boiler at 60lb. pressure is equal to the detonation of 1lb. of gunpowder; so that in the case before given there would be the same effect as from the explosion of about 500lbs. of gunpowder.

The explosions of vessels containing high pressure steam, but not exposed to any fire which would render possible any overheating or decomposition of steam, &c., cause as much havoc as the bursting of ordinary boilers, when the contents are suddenly liberated by rupture of the sides.

It has long been the object of engineers who have given especial attention to this subject to obtain accurate records of every case of boiler explosion, and I have done my utmost to assist in that object, and have obtained notice of more than 1,500 explosions, causing the death of 5,000 persons and the injury of some 4,000 others.

The records are discouraging in many respects, as they contain the names of some of the best and most careful engineering firms as owners of exploded boilers, and also give instances of explosion of nearly every form of boiler which has been in use for any length of time; for there are plenty of exploded locomotives, Cornish, Lancashire, and other boilers, once held to be almost incapable of explosion, as well as the more old-fashioned Balloon, Haystack, Butterley, or plain cylinder boilers.

In but few of the earlier explosions are trustworthy records obtainable; but for some ten or twelve years they have been far more complete and accurate, and their careful consideration has led to the conclusion that most of the explosions could have been prevented, had the actual condition of the boilers been known.

Nearly all who have given special attention to the matter being agreed that most explosions could be prevented if the condition of the boilers were known, the problem suggests itself—how are owners to keep themselves informed of the condition of their boilers? and the simple answer is, by periodical inspection.

Inspection may be done by any one, and its value will differ according to the care and intelligence of the inspector.

It may be well to describe what is usually meant by boiler inspection. To insure due attention, a written report should be made, which must be perfectly intelligible to any one who has not seen the boiler, and to prevent confusion no two boilers should be mentioned on one paper, and the report should be made complete at once, so as not to need fair copying, and illustrated with sketches. In the first place, every particular of boiler, and fittings, and setting should be noted that can be seen from the outside of the boiler, with sketches and sufficient dimensions to make complete detailed drawings if required.

The boiler should then be entered, and internal sketch and dimensions taken sufficient to make complete drawing. The plates should then be felt in every part with a light hammer, and the general condition noted.

The flues should be reserved for the last, because they are generally dirty, but this is often the most important part of the inspection. The fire grate and each flue should be entered and traversed, and every part of the boiler plates felt with a hammer, and also dimmensions taken as before.

This is not all that is necessary to obtain complete information, for there still remain those parts of the boiler in contact with the brickwork, and the neglect of which often leads to disaster. It is easy to clear the brickwork sufficiently for examination, but a little arrangement when setting the boilers would make it far easier, and will be again alluded to.

* Paper read May 31, 1870, before the Institution of Engineers in Scotland, by Mr. E. B. MARTEN.

It may be well to mention the chief impediments to carrying out this inspection. It is often impossible to make even the external examination, because boilers are so smothered up with brick and stonework. The clothing of boilers is often justly urged as leading to economy of fuel, but it should not be done in such a way as to preclude examination. The most rapid corrosion goes on if a leak should take place beneath the covering, especially if it consists partly of sand or ashes.

Internal examination is sometimes prevented by too small a man-hole, or one so awkwardly placed as to make it almost impossible to twist into the boiler; but the most usual difficulty is the want of room to move about, or to use a hammer. Sometimes also there is no means of cooling sufficiently to remain in the boiler many minutes.

Each form of boiler has its peculiar difficulties. The Cornish or one tube boiler is one of the most awkward, as there is so little space between the tube and shell at the sides and bottom, and a false step may cause the inspector to slip and become wedged. An instance of this occurred last year, where the plates of a boiler had to be cut out to extricate a man.

The Lancashire or two tube boiler obviates this difficulty, but involves another man-hole to get at the space beneath the tubes.

Most of the multitubular boilers, such as the locomotives, are too small to enter, and the impossibility of internal examination has led to many explosions.

Of course the difficulty of examination is much increased if the scale is not well cleaned off, as without this many a fault will be overlooked.

The easiest boilers to examine internally are the plain cylinders, or others without internal tubes, and this facility for examination is one of their chief recommendations.

The upright boilers, such as work from the waste gases from iron furnaces, are particularly easy to examine, as there is plenty of room to stand upright both inside and in the flues.

The flue examination is attended with some impediments, as in most boiler settings facility for entrance to the flues appears to have been the last consideration. In many cases entrance is simply impossible, as the brick work is only a few inches from the boiler. In not a few cases the man-holes are little cast-iron frames and doors, and too small for even a lad to pass through. Even when the flues of the Cornish and Lancashire boilers are large enough to pass along, the narrow space and inclined or crawling position is awkward. The plain flash flues of the externally fired boilers are easiest to examine.

The value of the examination when all the above expediments are overcome must depend on the knowledge of the inspector, as to the points to observe, and as to what mischief to be on the lookout for. Of course it is presumed that the boiler when fixed was a good one; the object of inspection being to ascertain whether it has become weak or dangerous while working.

It is often found that boilers have been injudiciously altered in form In one case the tube had been removed without due care in compensating for the loss of the support of the tube and the extra area exposed to pressure in the flat ends by suitable stays, and, of course, the end was blown out.

Great loss of strength is often caused by injudicious repair, even when there is no intended change in form of the boiler. Plain cylinder boilers originally constructed in rings with joints crossed, are often found so much repaired with patch upon patch that the seams become nearly continuous from end to end. The strength of such boilers it is impossible to calculate, as the metal must be exposed to unequal strains from the new and and more elastic plate not taking up its exact proportion.

The faults visible from the outside of the boiler are generally so apparent when the covering is removed that they can hardly escape detection. The chief danger is from corrosion from the neglect of leaking of joints.

The faults visible from the inside may more easily escape detection. In those boilers which depend upon stays for their strength, the stays need very careful examination to ascertain if there is any weakness. It is not at all uncommon to find stays of proper and good construction, but with the rivets attaching them to the boiler loose or nearly sheared off.

The effect of internal corrosion is generally easily detected, but there is a form of it called "furrowing" which may escape attention. It is found in Lancashire boilers, sometimes in the angle iron, and sometimes in the plate close to it, and as scale often fills the crevice or "furrow" it may escape notice. The same thing is found in locomotives just by the lap of seams. The furrows are supposed to be caused by the "fatigue" of the metal in certain lines of strain due to the bending backwards and forwards of the end of the boilers to accommodate itself to the varying lengths of the tubes and shell when expanded or contracted by alternate working or cooling. The same lines of strain are produced in the barrels of locomotives by their efforts to assume the truly circular shape. Not only is the metal in these lines rendered more open in texture and more liable to corrosion, but the scale is continually thrown off, exposing fresh surface. "Furrowing" should never be neglected, as it increases very rapidly when once it sets in.

The faults to be observed in the flues are numerous, but two or three only will be noticed. When boilers are patched the old metal is often strained or punished by the removal of the old rivets and the "drifting" to pull it up to the new plate. This not unfrequently sets up "seam rips" or cracks from hole to hole, which not only throws extra and ever-increasing strain on to the rivets at each end of the "rips," but often produces a jerk which causes such enormously increased strain upon each succeeding rivet that the whole seam rips round and allows the boiler to break up.

External corrosion is another most frequent fault visible from the flues. The leakages from a sprung seam will often run down the lap, causing a "channel" or narrow line of corrosion. This is often found also in the seams of upright boilers, on the upper side of the lap.

As the channel is seldom more than one or two inches wide it is easily seen by marked contrast with the sound plate, but when corrosion is more general from dampness in the flues it is not so quickly noticed, as the edge of the upper lap also corrodes, leaving the same apparent thickness at the edge of the plates, whereas, in reality, the lower plate may be eaten more than half way through. The same thing may deceive where a new piece of plate has been inserted on to a thin plate. Very slight corrosion of the already thinned plate may be much more dangerous than would be supposed from anything seen on the outside.

The corrosion which goes on at a point of contact with brickwork is one of the most frequent causes of anxiety to those who have the inspection of boilers, as it is sometimes found when least suspected. It is caused by the damp being held against the plate, and is the more dangerous as it produces weakness in long-continued lines in the directions of the greatest strain. The walls are often now constructed with removable bricks or slight holes at each seam.

It is very frequently asserted that corrosion cannot be the cause of explosion, as the weakened place would blow out and relieve the boiler. This may be the case when it is only local, but when in continuous lines, and the giving way of one point throws the strain on the surrounding parts, it leads to a break up, as described in the case of seam rips. In tubular boilers it is very necessary to measure both diameters of the tubes, to detect the first signs of weakness from the departure from the true circle.

Some few words are necessary as to the testing of boilers by steam or hydraulic pressure. The former is so dangerous and has led to so many accidents that it should be avoided. Attempts to caulk leaking seams while under steam pressnre have led to many fatal explosions. Many more fatal explosions would be caused from proving by steam pressure were it not that makers often deceive themselves and their customers by supposing that a large boiler can be proved by connecting a small inch pipe to another boiler, the gauge upon which shows the required pressure, whereas condensation goes on so rapidly that not half the pressure is ever reached in the tested boiler.

The hydraulic test is not attended with danger if all air is excluded from the boiler, but it is found in practice that it does not always detect dangerous furrows or corrosion. It is undoubtedly most useful when applied with judgment during the time of inspection, and should always be considered a necessary part of inspection, but it cannot be relied upon alone or as a substitute for inspection.

Many attempts have been made to construct boilers that should be free from all danger of explosion by having all the parts exposed to pressure of very small diameter and avoiding the large quantity of steam and water accumulated in ordinary boilers. Such boilers are made of both cast and wrought iron, but the experience with them is short, and for ordinary work the absence of accumulations of power makes it difficult to maintain regularity. In all descriptions of such boilers, however, although absolute safety from explosion is unhesitatingly promised, facility for inspection of every part is mentioned as one of the advantages.

Much of the information as to the causes of boiler explosions has been elicited at inquests upon those killed, and great advantage has resulted from publicity given to such proceedings. It is feared that much extremely useful information is lost to the public by the inquiries in Scotland being private. Some juries at inquests having arrived at very manifestly wrong conclusions as to the causes of boiler explosions, it has been sought to induce the Government to insist upon scientific evidence being obtained and published by coroners. If the Government deem it right to take any steps in the matter it will be much more likely that, instead of interfering with the most ancient institution of coroners' inquests, they will themselves obtain a special report from some competent person of their own selecting, as in case of railway accidents, whose evidence will be available if any coroner's jury should require it.

Inspection has often been recommended by juries at inquests, some having advocated compulsory inspection by Government. In both the last and the present sessions Bills on the subject have been introduced by private members. It is hardly to be supposed that Government will seek to legislate in the matter and introduce a system which, however well worked, cannot but be burdensome and expensive to boiler owners, unless strongly urged by public opinion, or unless it is proved that owners of boilers are not able or willing to inspect boilers without compulsion as carefully as could de done under stringent laws. It is the experience of other countries that laws which dictate arbitary regulations as to the use of steam are not found so effectual as those which leave discretion to the users of boilers.

One of the difficulties of legislation would be to define what should be considered a steam boiler, as many very small domestic boilers have exploded and caused great damage and loss of life, and inspection would be equally useful and necessary in such cases.

In conclusion I would submit that periodical inspection is the surest means of securing the safety of steam boilers. Also, that this inspection is a good and useful safeguard, if only done by the man in charge; but that it is a still greater safeguard if done by independent inspectors who have the experience of seeing many boilers and are not influenced by the exigencies of the manufacturers for whom the boiler may be used.

Such was the opinion of those who formed the Midland Boiler Inspection & Assurance Company, under whose auspices I have obtained a great deal of the information as to boiler explosions which I have been enabled to give to the public; and to whose courtesy I am indebted for permitting me to give whatever may be deemed useful in the present paper.

Since this paper was written I have obtained particulars of a very recent boiler explosion, which well illustrates many of the points mentioned.

The boiler was originally a good one. It was set very deeply in brickwork. The flues were narrow. The plates in contact with the bottom wall were reduced by corrosion to 1-16 inch. A correspondent of a local newspaper stated that a "bad boiler could not explode, as the corroded part would yield and allow the steam to escape harmlessly." Witnesses at the inquest expressed the opinion that there must have been explosion of hydrogen gas to account for the damage done to the property. The simple cause of the explosion was that the strength of the boiler had gradually become reduced by the corrosion, until unsafe to work at the usual pressure of 50 lbs., although it is possible that the pressure at the time of explosion might have been a few pounds above that. The first rent had evidently taken place at the corroded part, but as this was at the bottom and the steam could not escape owing to the surrounding brickwork, it could only find vent by forcing the boiler upwards, two rings of plates being torn off and thrown to a considerable distance, and the main portion of the boiler forced back and thrust through a wall. Neither the owner nor his men would have worked the boiler had they known the condition of the corroded part. That condition could have been discovered by inspection. There is every reason to believe that all concerned would most willingly have adopted inspection if it had been suggested. Few owners would allow their boilers to work without inspection at short intervals, if they could realize how many dangers may be averted by it.

A very interesting discussion followed the reading of the paper, in which the President, Professor J. M. Rankine, remarked with regard to what the author had said as to the explosive energy of a quantity of water confiined in a boiler working at high pressure, that it was a matter of calculation. That energy was found to increase very nearly as the square of the elevation of the temperature above 212deg.; and it reached an amount quite sufficient to explain the facts of any explosion, even when the boiler had flown away like a rocket. The results of those calculations showed how utterly unnecessary it has been to contrive theories of hydrogen gas and electricity, and so on, as the cause of boiler explosions—the fact being that boilers exploded because they were too weak, and because the water and steam had sufficient energy to destroy them. A formula for the eqplosive energy of heated water had been published by the Astronomer-Royal, Mr. Airy, and Professor Miller, but they had neglected to allow for the disappearance of heat in producing mechanical work. He had himself published a formula deduced from the laws of thermodynamics, in the Philosophical Transactions for 1854, and in the "Philosophical Magazine" for November, 1863. The object of the paper before the meeting was wholly practical, and related to so constructing boilers as to be inspected easily; and every one would admit the importance of that.

Mr. Faulds said there were some very extraordinary kinds of boiler explosions. The first one he had seen was when he was a young man at the Glasgow Ironworks. The boiler was 30ft. long, 6½ft. in diameter, and of 7-16in. plates. It had not been going a fortnight until it blew away to a distance of 300 yards. He also mentioned as a curious case where a tubular upright boiler had blown up to a great height and fallen down on nearly its original seat.

Mr. More said that during the last twenty years he had inspected a considerable number of exploded boilers in that city and neighborhood by order of the authorities; but having been cautioned never to give any report of anything he had seen during his investigations to any society or person save his employers, he could not now give any names or specify particular instances. He was not prepared to say whether the coroner's open inquest of England or the Fiscal's private investigation in Scotland was the best course to pursue, nor could he dogmatise on what caused boiler explosions, but he would give what he believed corroborative evidence of some statements in the paper, and back up what Mr. Faulds had said—that sometimes boilers exploded immediately after being thoroughly repaired, or after being first started but a day or two. He mentioned a case of an upright boiler which went up like a rocket 200ft. high, although it was 11 tons in weigh', and came down again through the roof within 3ft. of where it went up, sinking into the ground about 11ft. Another case was that of a plain boiler, 24ft. long and 4ft. in diameter, the one end of which was cut off as clean as with a pair of shears and blown the furnace end backwards a distance of 120ft., the boiler itself being projected 300ft., passing through the base of the stalk, and the weight of the safety valve was flung 100 yards further on. One thing he had observed which probably had to do with some explosions was, that young boys were sometimes left in charge of very large boilers. In one case of this kind he had seen the feed pump worked by an eccentric, and the lad in charge had a bit of string attached to the eccentric gab by which he engaged and disengaged the pump. In such instances there was great danger of the gab missing the pin and the boiler not being fed at all, and so in every case were there were defective arrangements for feed water. Another great source of weakness was in having all the openings into the boiler in a row, such as the man-hole, the safety-valve, etc., which weakened the boiler at a most important part He would rather have all those openings in a steam dome in the centre of the boiler, and so save cutting into the boiler at all. As to testing boilers. In testing boilers with cold water they were very much stretched, and he had seen cases where the rivets were twisted into a condition so that when the boiler came into operation it immediately gave way; and in another case the boiler had so expanded as that the rivets were nearly cut through. He also drew attention to the destruction of the front of the boiler below the ash-pit by allowing water to drip from the gauge cocks upon it.

Mr. George Russel would like to hear the members' opinions as to the comparative merits of double and single riveted boilers. It was very seldom that one saw a large boiler with double rivets; but he thought that they should all be made in that way. He thought this subject of boiler explosions was a good deal dependent on the class of iron employed; so that, after all, it came to be pretty much a commercial question.

Mr. Lyall said he would like to ask the last speaker what pitch he meant should be adopted in double riveting? So far as the strength was concerned, it would greatly depend on the increase given the plate section—which was generally weakest—at the points. He had not observed whether any mention had been made of the fatigue on plates at the points and at angles forming unions between different parts of steam boilers, through frequent expansion and contraction by variation of temperature and tension by steam pressure. He thought it was this action, combined with corrosion, which formed grooves or channels, as shown in one of the drawings. He thought it possible the same action was set up in the way of the brickwork, by unequal expansions of the boiler plates and that of the brick setting on which they rested. He feared this was the cause of such deteriorations, although it was generally attributed to corrosion; and questioned whether the waste in fronts of boilers, at the foot plate, as adduced by one of the speakers, was not due to wear by contact through expansion and corrosion together. A small quantity of gunpowder might be exploded on the hand without injury; but the same quantity having a sheet of paper laid over it would splinter a piece of wood on which it might be exploded. He thought the same atmospheric resistance caused boilers to explode by the bursting of even a very thin part. Reference had been made to hydraulic testing of boilers, and as a great many different opinions had been expressed on this subject from time to time he would like much to hear some of the members express their opinions on the value of such a system and its results. His own notion was that unless it was accompanied by an accurate system of gauging the different parts of a boiler, and avoiding a permanent expansion at any part in testing, it only ensured a greater care being taken in making by a knowledge that it was to be subjected to a test.

The President said that the author of the paper had not neglected the mechanical action; for he ascribed the furrowing of boilers to combined chemical and mechanical action; the mechanical action producing a tendency to throw off scale, and thus to expose places to increased chemical action. With respect to the direct effect of chemical action, he (the President) stated, that in an example that he had seen of a steam chest with a flat top, the angle iron cracked from the varying pressure of steam making the dome bulge out and become flat again, and thus working the angle iron backwards and forwards, and causing the gradual formation of a crack. There was a very important class of mechanical actions in boilers to which he thought sufficient attention had not been paid. He had received a letter from an eminent mechanical engineer on this subject; but he could not read it to them without that gentleman's consent. It showed that the weight of the boiler and of the water contained in it, taken in combination with the manner in which that weight was supported, had a material effect upon the tensile stress to which the boiler-shell was exposed. He thought a paper upon that subject would be of interest to that institution, and he would try to induce the gentleman to make such communication.

The Conductors' Insurance Association.

The New York *Tribune* gives the following account of the principles and operation of this association, the plan of which, it will be seen, it commends without reserve:

In August, 1868, a number of railroad conductors devised a plan of mutual insurance, whereby they could provide for their families some little assistance, in case of the sudden death of the heads thereof, by the inevitable accidents of their business, or any other fatal catastrophe. The object was to secure all the advantages, without the heavy expense, of life insurance. The plan was very simple, as well as very cheap. It was to gather as many as possible into an association, where each member of the association should pay, in case of death, $1 for the benefit of the family. The plan needs no further elucidation. If there are 1,000 members in the association, and one of them dies, the assessment is $2,500, of which, after office and funeral expenses, the family gets about $2,300 cash in hand, and no man feels it. Only one dollar each, as much as would pay for half a dozen cigars, does all this substantial benefit.

The excellence of this system is manifest. Every man knows the beginning and the end of the whole matter. It is simply $1 at the death of each member. Perhaps ten per cent. of this may be needed for current expenses; but $90 of each $100 will go to the bereaved family, or to whomever the deceased member may have indicated.

What is there to say against extending this principle to all trades and professions, or to all men? People hesitatate about taking life insurance, because it involves a considerable outlay at once, and the conditions are so rigid that if one fails to meet his payments, all that he has paid is forfeited, unless by the grace of the company he gets some sort of settlement outside of the law. Here there is no time prescribed; no man can possibly be thrown out of the benefit unless by the improbable refusal to pay his dollar. And the larger such society grows the greater must be the inducement to join. Of course the number of deaths will be in proportion, but the immediate benefit, cash in hand, with no obligation beyond gratitude, no legal papers nor technicalities, no tortuous proceedings in the courts, no lawyer's fees, no expenses of any kind, commend this simple system as one of the most useful and practical ever known. We cannot give a better illustration of it than by copying the table of deaths and benefits paid in 1869:

TABLE SHOWING THE NO. OF DEATHS DURING YEAR, & CLAIMS PAID.

Name of deceased.	Cause of death.	Assessment.
J. T. O'Brien	Killed	$796
James Dawson	Killed	1,124
C. R. Gillett	Killed	1,482
T. N. Corwin	Shot by passenger	1,700
E. O. Latham	Killed	1,733
P. Thompson	Typhoid fever	2,079
T. J. Oates	Shot by hotel keeper	2,082
H. Cartice	Injuries received on train	2,251
John Corbett	Rupture	2,317
S. Hendershott	Rheumatism of heart	2,363
Wm. H. Briggs	Disease of the kidneys	2,445

Compound Engines.

In the year 1776, when Jonathan Hornblower first began experimenting upon the expansion of steam in two cylinders successively, there were probably no engines in use supplied with steam at a much higher pressure than two or three pounds per square inch above the atmosphere. Viewed by the light of our present knowledge, the employment of the double-cylinder system under such circumstances appears little better than an absurdity, and it is not to be wondered that, after some years of trial, it was found that Hornblower's engines could not compete successfully with the single-cylinder engines of Watt. To this result, the fact that the independent condenser invented by Watt in 1769 was found to be a necessary adjunct to Hornblower's engine, no doubt, in some measure contributed. Thus matters remained until early in the present century, when, almost simultaneously, Richard Trevithick and Arthur Woolf pointed out that, in order that steam should be worked expansively with economical results, the initial pressure must be much higher than had hitherto been used. Trevithick applied high-pressure to Watt's ordinary single-cylinder or Cornish engine, while Woolf revived and modified Hornblower's engine, and, by working it with high-pressure steam, obtained results far beyond those of the original inventor. Woolf's first engine was erected at Meux's brewery in 1806, but it was not until some seven years later, when he took up his residence in Cornwall, that the second competition between single and double-cylinder engines can be said to have fairly commenced. At first the economy obtained by Woolf astonished the Cornish engineers, but ultimately they found that high pressure steam applied to the single-cylinder engines produced equally good results, and thus, for the second time, the double-cylinder engine was beaten from the field by its more simple rival.

The facts we have stated are well-known matters of history, and we should not have alluded to them here had it not been that at the present time they possess a special interest. During the past ten years or so the double-cylinder engine has been again revived, and both on sea and land results have been obtained with it which justify the opinion that, in all cases where great regularity of motion or great economy of fuel is desired, it is *the* class of engine which should be adopted. Of course such a complete reversal of the former decisions on the single *versus* double-cylinder engine question is not likely to be at once universally accepted, however conclusive the proofs may be to those who analyze them; and there are, accordingly, not wanting those who, either not caring or not being able to investigate matters for themselves, fall back upon the results of Hornblower's and Woolf's days, and, ignoring present data, maintain that there is "nothing in" the compound engine. Under these circumstances it appears to us worth while to point out why the results of the rivalry between Watt and Hornblower, and Trevithick and Woolf, cannot be considered to apply at the present day; and at the same time to show why, in our opinion, the compound engine is likely to take a still higher position in the future.

We have already stated that in the days when Watt and Hornblower were rivals, the pressures of steam used were so low that the degrees of expansion requisite to develope the capabilties of the double-cylinder system were unattainable; and we may therefore dimiss this competition as not requiring discussion here. In the competition between Woolf and Trevithick, however, the circumstances were different, and the pressures of steam and degrees of expansion used were such as have since been adopted in compound engines with highly satisfactory results. This being the case, and it being also an undoubted fact that the double-cylinder was eventually beaten by the Cornish engine, the question is asked by some engineers why, at the present time, compound engines are daily growing in favor.

To be able to answer this question, it is necessary to understand clearly what advantages the double-cylinder possesses over the ordinary single-cylinder engine. These are really but three in number, and of these three but one can be said to directly conduce to economy of fuel, the other two relating more to the economical maintenance of the engine, and hence affecting the consumption of fuel indirectly. Theoretically, of course, the expansion of the steam in two cylinders successively possesses no economical advantage over an equal degree of expansion carried out in a single cylinder; and practically, there is a certain loss involved by the employment of the double-cylinder arrangement, owing to the loss of pressure in the passages by which the two cylinders are placed in communication. Any loss due to this cause, however (so long of course as proper proportions are used), is far more than counterbalanced by the fact that, in the double-cylinder arrangement, the cylinder receiving the high-pressure steam is never cooled down much below the temperature of that steam, and the low-pressure cylinder, in fact, forms a kind of heat-trap between the high-pressure cylinder and the condenser. This fact, which constitutes the first great advantage of the double-cylinder arrangement, has long been well-known and recognized; but there has apparently been in many quarters a disinclination to estimate it so highly as it really deserves. All, however, who have carfully watched the performance of compound engines—and especially engines working with high degrees of expansion—must have become convinced that this advantage is one of vast importance, and that it is almost to it alone that the high duty obtained from well-constructed double-cylinder engines is due.

The second advantage of the compound engine, and the one perhaps that is most generally attributed to it, consists in the regularity of motion which can be obtained with it, and the facilities it affords for vastly reducing the sudden strain thrown on the moving parts at the commencement of each stroke. Of this advantage we need not speak further at present. The third advantage lies in the fact that with the compound engine the effective differences of steam pressure tending to cause leakage past the pistons and valves are much less than in the single-cylinder arrangement, and the difficulty of deeping these parts tight is therefore greatly diminished and the friction reduced. This advantage is one of which we have spoken more fully on former occasions.

We must now point out why the advantages we have enumerated did not enable the engines of Woolf to compete successfully with the Cornish engine, and to do this we must draw attention to a fact which, although it can scarcely have escaped notice, has yet so far as we are aware never been advanced to account for the double-cylinder being an unsuccessful rival of the Cornish engine. This fact is that the first and great advantage which we have mentioned as attending the employment of the double-cylinder system is possessed in a great degree by the Cornish engine also. In other words, it follows from the manner in which the Cornish engine is worked, that but a small proportion of the surface exposed to the fresh steam from the boiler is ever reduced to the temperature due to the vacuum formed in the cylinder by opening the communication with the condenser. Let us consider, for instance, the case of a Cornish cylinder having an 80in. cylinder 10ft. stroke, working with a cut-off at one-sixth. In such an engine the piston would probably be about 12in. deep at the edge, and the length of the cylinder between covers would be about 11ft. 4½in., thus giving 2¼in. of clearance at each end. Now, when the point of cut-off is reached, the internal surface exposed to the steam would consist (disregarding steam passages) of the area of the top cylinder cover + the area of the top of the piston + the surface of the cylinder itself between the piston and cover, or in all about 15,645 square inches. On the down stroke of the piston being accomplished, the equilibrium valve would, of course, be opened and the piston caused to perform its upward stroke by the load at the pump end of the beam, the communication with the condenser not being open until the equilibrium valve had been closed and the piston had reached the top of its stroke. Under these circumstances the only portion of the 15,645 square inches of surface we have mentioned, which is exposed to the cooling effect due to the formation of the vacuum within the cylinder, is that which projects below the piston when the latter is standing at the top of the stroke. Thus, in the 15,645 square inches was included the internal surface of the cylinder for a length of 22½in., and of this length 8in. will extend below the piston when the latter is at the top of its stroke. But the surface corresponding to the length of 8in. is but 2,010⅛ square inches, or but little more than one eighth of that exposed to the steam at full boiler pressure. Moreover, this surface of 2,010⅛ square inches is exposed to the cooling motion due to the formation of the vacuum for but a very brief period; whereas, in the ordinary double-acting rotative engine, those parts of the cylinder surface which have been most highly heated are exposed to the cooling action during an entire stroke.

These facts, while they show that the double-cylinder arrangement possesses no such advantage over the Cornish as it does over the ordinary single-cylinder rotative engine, and thus explain to a great extent the result of the Woolf and Trevithick competition, afford also an important reason for the economy of fuel which has attended the employment of the Cornish engine. It will, in fact, be seen from what we have stated, that in the Cornish engine the piston and equilibrium valve serve—although less perfectly—much the same purpose as the second cylinder in the compound system, and that, therefore, a competition between the double-cylinder and Cornish engines was a very different thing to the competition between compound and single-cylinder rotative engines, such as is going on at the present day. Moreover, in the competition with the Cornish engine, the second and third advantages which we have mentioned as attending the double-cylinder arrangement, went almost for nothing, and thus the result of the Woolf and Trevithick is altogether fully accounted for. We have said that we anticipate the more and more extensive adoption of the compound engine, and the reasons for this are, we consider, self-evident. As steam of higher and higher pressure is used, the action of the second cylinder in preventing the cooling of the surfaces exposed to this steam becomes of more and more importance; while, as higher degrees of expansion are resorted to, the greater equality of driving pressure obtainable by the double-cylinder arrangement rapidly increases in value. The compound engine certainly does not possess the charm of novelty; but it possesses the greater charm of having proved by its performances that it is well entitled to the esteem of users of steam-power.—*The Engineer.*

Flexibility and Elasticity.

It is rather a hard thing to make some railway mechanics believe that rolling stock is benefited by giving it an elastic and flexible character. They all seem to know that springs are necessary on cars and engines; but then a spring is a spring, and when one has been put on the last thing that is thought about is whether or no it fulfills the real object for which a spring is required. Thus you may find one engine runs with a succession of hard, rough, shaking motions; while another goes along with an easy gliding movement that is not only very easy and pleasant, but is at the same time very economical, so far as the wear is concerned, both of the engine and the track. Some engines and cars run as though the brake was in constant use on them, while others *slide* as smoothly as though the wheels were sleigh runners upon an oily platform or other smooth way. This difference all comes from the means taken to secure the requisite *degree* of elasticity. It does not follow that the more elasticity given the easier the movement; it is the skilful *adaption* of the elastic principle to secure the right movement. And this depends a great deal upon the men who have charge of construction and repairs. There is no exact formula that will give the right degree of elasticity even to engines of the same weight and class; a great deal depends upon the skill and discretion of the men in charge, and the possession of this skill and discretion is so important, that the possession or non-possession of it often makes a difference of several cents per hundred miles in the repair expenses. A master mechanic who is fit for his business should be capable of seeing all these matters at a glance, and of rectifying all that is shown wrong after the first trial trip; and if he is a good judge of the qualities of the men as he ought to be of machinery, he will be likely to keep the expenses per mile of operation down to a reasonable figure. If a new engine is brought upon the road, and, as is often found, is "hard on the track," a capable mechanic will soon know what the trouble is and how to rectify it, and this applies to cars of every kind as well as engines. But applying the requisite degree of elasticity to rolling stock is not all that is required to keep the repairing and operating expenses within a reasonable figure. Elasticity must be given to the track, and here skill and discretion are of just as much value as in the machinery department. The "permanent" way is not secured by laying rails on stone sleepers, or other material hard and inelastic, as Brunel thought; in fact, such a track is the easiest to knock to pieces that there is. The more solid the substructure the worse it is, unless some slightly elastic medium is interposed between it and the rail, and so in modern practice success has only been achieved by a skilful adaptation of this elastic principle. The devices for this are numerous: chairs with cushions of wood, rubber, or felt, are used, and with good success just in proportion to the skill employed in their use. What is wanted is just enough elasticity to absorb the shock of the driving wheel, so that it shall not hammer itself and the rail to pieces: it is merely putting the tan-heap under the anvil. The improved sleeper which we have illustrated in another column answers this purpose well. The sawed oak slab inserted in the sleeper secures a sort of air cushion to take up the blows of the passing wheels, while it does not give *spring* enough to disturb the hold of the spikes. It acts like the frog in the foot of a horse, or the cartilage in his knee. We shall never succeed in getting the best results in railway machinery unless we take advantage of these simple lessons from nature.

There are other destructive forces in railway operation which it is necessary to guard against. Modern engineering has introduced into the railway curves of very sharp radius. These are at all times objectionable, and very destructive to the rolling stock, unless there are devices formed for preventing the ill effects. Thus instead of using rolling stock with a long rigid wheel base, we borrow from nature again, and the rolling stock is vertebrated, like the spinal column, and capable of winding through sharp curves without hard abrasion of the wheel against the rail, thus saving the torsion of axles, the breaking of wheels and rails, and the straining of engine frames. The swing beams for cars, Fairlie's engine, Bissel's engine truck, and his tender truck, and other devices of the same character, all show the tendency of modern and successful practice. These give flexibility to the rolling stock, while allowing a very long wheel base, and do not prevent entire steadiness of movement; in fact, we think they aid very materially in that respect. There are many master mechanics, however,—they are growing rapidly less in number though,—that still question the advisability of applying some the most important of these devices, preferring the rigid wheel-base with all its distributing elements to the more simple, philosophical and natural practice which modern mechanical ingenuity has made practical in the best sense of the term.

The dislike to change or to add patterns to the machine shops, taken in connection with rusty prejudices, prevents the adoption of many useful and indispensible improvements. The history of every improvement in steam locomotion proves this; but still from year to year substantial progress is made, all in the interest of safety and economy.—*American Railway Times.*

A locomotive engineer writes as follows to the *Locomotive Engineer's Journal:*

"One thing that has had a great deal to do with the cost of repairs on our road, has been steel crank pins. Our engines are from the Rhode Island Locomotive Works, of Providence, cylinders 17x22, and drivers five feet with steel tyre; out of six engines on regular trains, four have broken crank pins, besides doing a great deal of damage otherwise in consequence of breaking pins. These engines have all steel pins. I have but little faith in them; I think that good Low Moor iron is better in all respects, with less liability of breaking, and thus avoiding all other breakages happening with breaking crank pins; at least such has been my experience. I am still open to conviction, and if there is anything to be said in their favor, I would like to hear it, as I have failed to see any thing. In one instance where two engines ran together in the yard, both forward crank pins on one of the engines broke short off, neither engine striking hard enough to do any other damage. Our road is a new one and consequently is somewhat rough."

—A. J. Cassell, the General Superintendent, John A. Wilson, Chief Engineer of Maintenance of Way, Joseph M. Wilson, Principal Assistant Engineer of the Construction Department, Theodore I. Heizmann, Resident Engineer of the Philadelphia Division, Robert Nelson, Superintendent and Resident Engineer of the Western Division, Henry W. Wilson, Assistant Engineer of the Construction Department, Thomas M. Cleeman, Assistant Engineer of the Construction Department, Charles P. Perkins, Assistant Engineer of the Western Division, and Robert C. Peebles, Assistant Engineer of the Pennsylvania Railroad are all graduates of the Troy Polytechnic Institute.

General Railroad News.

TRAFFIC AND EARNINGS.

—The Boston, Concord & Montreal Railroad extends from Concord N. H., northwest to Wells River, Vt., 93½ miles, with a branch from Wells River northeast through Littleton to Whitefield, N. H., 31 miles, 21 miles of which is leased.

The earnings of this road for the year ending March 31, 1869 and 1870, were as follows:

	1869.	1870.
From passengers	$173,323 12	$179,425 95
" freight	326,795 85	309,845 22
" mails	18,900 01	16,168 49
" express	5,000 01	6,250 00
" miscellaneous	545 31	833 50
	$524,564 30	$506,523 16
Expenditures, viz:		
Maintenance of way	$151,103 85	$173,426 61
" motive power	103,184 67	108,439 16
Cost of working road	103,733 49	108,308 31
" management	10,404 87	11,184 16
Miscellaneous	20,874 98	23,683 06
	$389,300 86	$425,831 30
Net balance	$135,263 44	$80,691 86

—The North Carolina Railroad extends from Goldsboro (48 miles southeast of Raleigh), northwest to Hillsboro, 88 miles, west to Greensboro, 42 miles further, and thence southwest to Charlotte, 93 miles, making a total length of 223 miles.

The gross earnings of this road for the years ending May 31, 1869 and 1870 compare as follows:

	1869.	1870.
From passengers	$196,187 95	$233,753 52
" freights	364,140 90	405,066 63
" mail	16,725 00	16,725 00
	$577,053 85	$655,545 15
Expenditures:		
Transportation	$119,067 46	$144,500 26
Motive power	25,928 02	32,817 63
Cars	39,612 52	52,233 41
Maintenance of road	94,040 07	106,057 25
Subsistence	17,716 95	6,214 76
Maintenance buildings	9,662 07	9,730 39
" bridges	8,269 43	5,529 72
Stock killed	1,583 25	2,294 53
Interest	71,390 12	47,742 71
Incidentals	7,289 49	4,741 96
New rails, chairs and spikes	72,655 34	53,450 38
Taxes	2,869 14	2,237 02
Total expenditures	$470,083 86	$466,649 02
Excess of receipts	188,033 16	253,553 47
Included in the expenses are "old" as follows	69,972 92	73,520 08
Excess of receipts over "new" or current expenses	$257,006 85	$327,073 55

—For the week ending August 5, 1870, the receipts of the Great Western Railway of Canada were:

Passengers	$33,070 46
Freight and Live Stock	41,599 57
Mails and Sundries	1,909 05
Total receipts for week	$76,579 08
Corresponding week, 1869	57,773 45
Increase	$18,805 63

—According to the Marysville *Appeal*, an experiment is soon to be made in shipping grain from California to New York by rail! The *Appeal* says: "Two of the enterprising mercantile firms of this vicinity, have entered into arrangements with the Central Pacific Railroad Company, by which the expediency and profit of shipping flour and wheat direct to New York by rail, will be tested. Ten cars came up yesterday from Sacramento, three of which will be loaded by Trayner & Ellis, of Marysville, with flour manufactured at the Marysville Mills, and the other seven cars will be loaded with wheat at Chico, by W. A. Holcomb & Co. The rates of freight agreed upon are not made public, inasmuch as the enterprise is entirely an experiment on both sides, the shippers endeavoring to test the rates they can afford to pay to ship to a profit, and the Railroad Company desiring to satisfy itself as to the lowest freight tariff that can be profitably established on this class of shipments."

OLD AND NEW ROADS.

Canada Central.

Up to July 1, 1870, $286,558.51 had been expended on the section of this road between Ottawa and Calston Place.

Springfield & Illinois Central.

The contractors hope to have the road completed from Shawneetown to the Illinois Central by the first of December. The gap between Edgewood and Pana is to be finished early in the spring.

Springfield & Northwestern.

The contract for building this road has been awarded to Messrs. Kilbourne, Kettle & Hastings, of Keokuk. The road is to be built to Lewiston, Fulton county, a distance of fifty-five miles. Work will be commenced on it in thirty days, and it will be pushed through inside of one year. The subscriptions along its line amount to $6,000 per mile.

Iowa Southwestern.

The survey of the Iowa Southwestern road has been completed. The Tipton *Advertiser* says the line is located from Clinton to Tipton, and thence comprises two lines almost entirely across Cedar county—from London and from Clinton to Tipton, and from Tipton toward Iowa City *via* the Nicholson Creek and the Cedar Bluffs routes; two lines through a greater part of Johnson county; and a line to Sigourney, in Keokuk county.

Atchison & Nebraska.

A contract has been made between the company and Mr. Joy which will probably insure the completion of the road. The terms of the contract are substantially in accordance with Mr. Joy's proposition of which the following is a summary:

"If the present company will complete the grading to the state line, which is now almost finished, and transfer the entire stock of the Company to him, including the stock of Atchison and Doniphan counties, he will iron and stock the road, and have cars running to the State line by the first of January next. The stock is to be placed in the hands a trustee, and Mr. Joy is not to receive a dollar of it until the road is in operation to the State line according to contract. Within three days after he receives notice of the acceptance of the proposition by the company and the commissioners of the two counties, he will commence shipping the iron which he now has on hand."

Towsontown Railroad.

The road-bed for this line has been partly graded for some time from Rela House seven miles north of Baltimore on the Northern Central Railway, east to Towsontown, the county seat of Baltimore county, about five miles. This will soon be completed and it is intended to extend the line northeast about 25 miles further to the Susquehannah River.

Milwaukee & Northern.

The New York *Tribune* learns that the company are now shipping iron to complete the first section of their road to Cedarburg, about 20 miles from Milwaukee, and that it will be open for traffic in November next. Contracts are let to reponsible persons to finish the road to Green Bay.

The Winona Eastern Connection.

The contract for leveling the grade preparatory to laying the track on this road has been let to Mr. George Shannan, who will commence work immediately. As soon as the ties can be put down—probably next week—the track will be laid from the river to the bluffs and cars will be put on to haul stone to put in around the bridge, piers and pilings.

Missouri River, Fort Scott & Gulf.

Mr. Joy has ordered a survey and estimate of the cost of construction to be made from Columbus, on the Missouri River, Fort Scott & Gulf road, to Chetopa, which is about twenty miles southwest and on the Missouri, Kansas & Texas road. The Chetopa *Advance* says: "Messrs, Crichton & Hibbets have returned from Detroit with Mr. Joy's written assurance that 'so soon as we shall perfect our surties, he will, without any reasonable doubt, construct the road.'" The amount, in bonds, offered by Chetopa for the extension of the road is $75,000.

Laclede & Fort Scott.

Proposals for clearing, grading and masonry of 40 miles of the line from Buffalo, Mo. (30 miles west of Lebanon), westward will be received up to the 15th inst. The work will be comparatively light, it is said, with very little or no rock. At the same time, probably, proposals will be received for ties and tracklaying and rolling stock for the whole line, beginning this fall with the 30 miles between Lebanon and Buffalo, which will be ready within 30 days. If possible this part of the line will be open for business before winter.

Connecticut Western.

This road extends from the west line of Connecticut seven miles south of the northwest corner, and within two miles of Millerton on the Harlem Railroad, in a northeasterly direction through Salisbury to North Canaan, where it crosses the Housatonic Railroad, thence in a generally southeasterly direction through Norfolk, Winsted, Barkhamstead, New Hartford and Collinsville to Farmington, where it crosses the Canal Railroad, and thence east by north twelve or fifteen miles to Hartford. At Collinsville it is to have a branch northeast to Springfield, Mass. The western outlet of this road will be by the Dutchess & Columbia Railroad, which extends south by west to a connection with the Boston, Hartford & Erie road 22 miles northeast of Fishkill. The Connecticut Western by the terms of the contract is to be completed this fall; but it will hardly be open for business before next spring.

South Pacific.

A joint committee from Parker, Chetopa, and Baxter have gone to Boston, to lay before the Directors a proposition to run the main line of the road west, from Pierce City, nearly on the line between Kansas and the Indian Territory, till it reaches the 96th meridian.

St. Louis & Iron Mountain.

The company has now completed the inclined planes at Belmont necessary for the traffic of cars across the river. The inclined plane at Columbus on the other side is also finished and the first engine has passed over. The regular transfer of freight and passenger cars will be inaugurated on the first of September.

Northern Pacific.

This road, as now located for the contractors, will cross the Mississippi at a point twelve miles above Crow Wing, which has been named Ogema-qua. The bridge will be fifty-five or sixty feet above high water, so as not to interfere with navigation.

The St. Cloud *Journal* says of the branch line from that city: "Mr. C. H. Alsop has started with a party of seventeen men (with four pack horses and one team), to make another survey for the branch line of the Northern Pacific. He will run northwest from here. Whether he will intersect the main line near Otter Tail or near Crow Wing depends entirely on the character of the country, and cannot now be told. The party will be absent about four weeks.

"The impression seems to be that, owing to the unsettled condition of financial affairs, work will not be commenced on the branch line until after the main line shall have been completed to Red River, which will be by next July. In the meantime, all the necessary surveys will be made, and a line probably definitely determined on."

Little Rock, Pine Bluff & New Orleans.

Mr. J. M. Lewis, President of the company, states that there are twenty-five miles graded and ready for the ties from the Mississippi River toward Pine Bluff. Six thousand ties are ready and delivered. Thirty-five hundred bars of rails, with fish-bar fastenings and spikes for the same, are now at Chicora, present terminus of the road. Chicora is about twenty-five miles below the mouth of Arkansas River. Tracklaying will commence on this road the last of this month. Trains will be running through to Pine Bluff by the 1st of January next. Over six hundred men are at work grading, and a much larger force is expected soon.

Mississippi, Ouachita & Red River.

Mr. E. L. Pratt, Superintendent of Construction, informs the Little Rock *Republican* that he has 200 hands at work now, and hands arriving in squads of from fifty to eighty upon every down boat. Agents have engaged the services of 700 hands, all of whom will arrive by the last of this week. This road starts at Eunice, Arkansas, on the Mississippi, running through Monticello, crossing the Ouachita at Camden, and connecting with the Cairo & Fulton Railroad at or near Fulton, for all points in Texas. The iron and rolling stock have been purchased, and as soon as tracklaying commences, which will be about the first of September, there will be an average of about one mile per day laid.

Southern Minnesota.

The track was laid on the 27th inst. to Spring Valley and, we believe, trains are now running from Wells to that point. This leaves a gap of only about 16 miles between Ramsey and Lanesboro, which will probably be closed within the fortnight. It is thought that the grading between Wells and Winnebago will be completed in about six weeks, and the cars may run to that point by November 1st. The Mankato line will not be completed this season owing to the heavy work on the north end, but the cars will probably run through in the spring or early in summer. One hundred and seventy-five box freight cars, and two splendid passenger coaches, being built in Hokah, will be ready for the Fall business as soon as the 150 miles from La Crosse to Wells are completed.

Terre Haute & Indianapolis.

The following announcement is made over the signature of W. R. McKeen, the President, dated August 1: "The Terre Haute & Indianapolis Railroad Company have assumed control and management, by lease, of the St. Louis, Vandalia & Terre Haute Railroad. It will be known at the Vandalia Division. The following management is announced: R. A. Morris, Secretary and Auditor; M. W. Williams, Treasurer; Charles R. Peddle, General Superintendent, Terre Haute, Ind.; John W. Conlogue, Superintendent Vandalia Division, St. Louis, Mo.; John E. Simpson, Superintendent Indianapolis Division; H. W. Hibbard, General Freight Agent, Indianapolis, Ind.; F. Chandler, General Ticket Agent; N. Stevens, General Agent, St. Louis, Mo.; J. H. Hager, Paymaster, Terre Haute, Ind."

We learn that six new Pullman coaches manufactured at Dayton, Ohio, were put on this line last week to run through between St. Louis and New York. Two fine coaches belonging to the Pullman Company are running through between St. Louis and Cincinnati and the well known Pullman hotel car, the Revere, is running through between St. Louis and Louisville, and will soon have one or two companions of the same sort.

The regular passenger equipment of this road is of remarkable elegance and beauty of finish. The day passenger cars and the baggage cars are of uniform pattern, high, double-decked, and painted a rich new color with gilt. Finer trains it would be hard to find on any road.

Davenport & St. Paul.

Track is going down on this new road at the rate of nearly a mile a day.

Iowa Northern Central.

The grading of this line is completed from Keokuk northward to Mount Pleasant, about 40 miles, and the iron is expected soon.

Sioux City & Dakota.

The engineers have made the final survey of this line between Sioux City and Yankton.

St. Joseph & Denver.

It is said that there are two parties trying to obtain possession of this road, and that both intend to secure the corporate subscriptions, including half a million of dollars from the city of St. Joseph, and give the corporations nothing to show therefor.

Delaware, Lackawanna & Western.

This company has issued a circular stating that they will sell to the stockholders their stock at par to the amount of $3,000,000, payable in full on or before the 15th instant. The par value of the stock is $50. The transfer books will be closed until the 20th of September. This extra issue is for the purpose of covering the earnings from the investment in the Nanticoke Coal and Iron Company, which has been merged in the Delaware, Lackawana & Western Company. This is now one of the greatest of the coal roads, operating about 400 miles of railroad, and supplying a large part of Central New York.

Fort Wayne, Muncie & Cincinnati.

This road was completed on the 27th ultimo. For some time there has been an unfinished gap south of Bluffton. It extends from Fort Wayne in a southerly direction through Bluffton, Hartford, Muncie, Newcastle and Cambridge City to Connersville, on the Whitewater Valley line of the Cincinnati & Indianapolis Junction Railroad, 67 miles northwest of Cincinnati. Its length is 109 miles, and it furnishes a route from Fort Wayne to Cincinnati, 176 miles long. It has been leased by the Cincinnati & Indianapolis Junction Railroad Company for 99 years, and is operated by that corporation. It is said that it will be operated in close connection with the Grand Rapids & Indiana Railroad, which in a few weeks will have a line in operation extending 200 miles north of Fort Wayne. This will give Cincinnati access to a territory from which heretofore it has been quite isolated.

Fort Wayne, Jackson & Saginaw.

This road will be completed to Fort Wayne next week. It was completed from Jackson, Mich., southwest to Angola, Ind., 56 miles, last season. The entire line to Jackson is 95 miles long, and is to form a close connection with the Jackson, Lansing & Saginaw Railroad, forming a line from Fort Wayne northeastward to Wenona, fifteen miles beyond Saginaw, 211 miles long. It is one of the "Joy" roads, and its bonds are guaranteed by the Michigan Central Company.

The New Dayton & Cincinnati Line.

It is reported that an arrangement has been made between the Vanderbilt companies, and the Indianapolis, Cincinnati & Lafayette Company, by which the former will connect the proposed new line from Dayton with the Cincinnati depot of the latter company.

Cincinnati to Omaha.

It is intended to commence running trains through between Cincinnati and Council Bluffs on the 17th inst. These trains will pass over the Indianapolis, Cincinnati &Lafayette Railroad from Cincinnati to Indianapolis, the Indianapolis, Bloomington & Western from Indianapolis to Peoria, the Chicago, Burlington & Quincy from Peoria to Burlington, and the Burlington & Missouri River thence to Council Bluffs. This forms a route 709 miles long, which is nearly 100 miles shorter than by way of Chicago.

The line is to be provided with Pullman sleeping and drawing room cars, elegant day coaches, and will doubtless obtain a large share of the business between Cincinnati and the Union Pacific.

Quincy & Carthage.

Tracklaying was commenced on the 30th ult. It is expected that the road will be completed by the 1st of December.

Evansville, Henderson & Nashville.

This company is offering $600,000 of first mortgage seven per cent. bonds to raise money to complete the gap of 33 miles in the line between Henderson and Nashville. Twenty-three miles of this section are graded and under contract. J. Edgar Thomson, President of the Pennsylvania Railroad, is the Trustee of the company. The bonds are offered at 82.

Union Pacific.

Since the completion of the Kansas Pacific freight rates from Omaha to Denver have been reduced to $2 per 100 lbs. on first-class, $1.50 on second, $1.15 on third, and $1 on fourth class.

Ottawa, Oswego & Fox River Valley.

The grading between Geneva and Batavia, 2½ miles, is to be completed by the end of next week, and between Aurora and Batavia, seven miles, ten days later. All the iron is purchased and on the way, and rails are going down from Ottawa northward at the rate of about three-quarters of a mile a day.

San Francisco & North Pacific.

The first spike on this road was driven on the 30th ult. at Petaluma, which is some distance north of San Francisco and connected with the California Pacific Railroad (Vallejo and Sacramento).

Oregon & California.

This road will be completed from Portland to Salem next week.

Central Pacific.

The buildings of this road at Auburn, Cal., 36 miles northeast of Sacramento were burned on the 30th ult. The loss is about $20,000.

LOCOMOTIVE STATISTICS.

Burlington & Missouri River.

Mr. George Chalender, Master Mechanic of the company, makes the following report for the month of June, 1870:

Miles run by passenger trains	34,790
" " freight trains	63,414
" " miscellaneous trains	42,055
Total number of miles run	140,259

The average cost per mile run was:

For repairs	5.17 cts.
" oil, waste and tallow	0.92 "
" fuel	8.23 "
" engineers, firemen and wipers	7.00 "
Total cost per mile run	21.32 cts.

The average number of miles run was:

To one cord of wood	68.75
" " ton of coal	42.45
" " pint of oil	14.39

Coal is charged at $3.50 per ton and wood at $3.40 per cord. Forty-two locomotives made mileage during ing the month, 1 was rebuilding, and 2 were in shop on account of accident. All of the locomotives, except two, are coal burners.

MECHANICS AND ENGINEERING.

Performance of a Locomotive.

Wm. A. Hume, the engineer writes as follows to the *Locomotive Engineers' Journal* of the performance of locomotive No. 3 on the Mississippi & Tennessee Railroad: "Engine No. 3 is of Fairbanks' manufacture; 15 " inch cylinder, 22 inch stroke, 4 feet 6 inch driver. The " engine had a general rebuilding by Mr. Henry Teague, " our worthy Master Mechanic, and came out of the " shop July 25th, 1869, and has run ever since on regular " passenger trains, making an average of 3,154 miles per " month, or 37,848 miles during the twelve months end- " ing July 25th, 1870. The engine is still running, and " I am satisfied that it can do the same running during " the next year without going in for general repairs."

Louisville & Nashville Shops.

The Louisville & Nashville Railroad Company have been gradually increasing their facilities for manufacturing their own rolling stock. They are now building 100 box cars, have just completed 3 passenger cars, and have 3 more under way, of latest style and improvement. The demand of business increased last year so rapidly that the company were compelled to enlarge their shops to keep up their machinery. They are now building a new wood machine shop 200x70 feet, two stories high; the lower story to be filled with the best and most modern machinery for building and repairing cars. The second to be used for upholstering and pattern work. Another for erecting cars, nearly 300x82 feet wide; also, a blacksmith shop to be built, 200x70 feet, which will be equipped with the best hammer, bolt-makers, etc., and forging machinery. The foundry is melting about eight tons of pig iron per day in car wheels, etc., and a number of tons of wrought iron worked up daily.

St. Louis Transfer.

Last week the Wiggin's Ferry company commenced the transfer of cars from the Ohio & Mississippi, Vandalia and other roads centering at East St. Louis to the elevator and North Missouri road in St. Louis. This transfer is made by a barge upon which tracks are laid and, in instances, with thirty cars of corn for Cincinnati. When cars are merely sent over to load at the elevator, they are not removed from the barge, but the grain is spouted into the car from the " leg " of the elevator.

Traction.

The resistance to draught on dirt or gravel roads is about 148 pounds to the ton. On a well-constructed macadamized road it is not far from 66 pounds to the ton. On a good pavement, say granite or Belgian, it is about 33 pounds to the ton, while on an iron rail track it is 3 pounds to the ton. These facts show that a horse will draw about three times as much on a macadamized road as on a common road, four and a half times as much on a pavement, and eighteen times as much on an iron rail. This conclusion, of course, implies that the horse has the same secure foothold in each given case.

Steel Spring Motor for Street Cars.

The following is a description of a new application of steel springs which has been patented recently by P. E. McDonnell, of Chicago:

"In the device, coil springs about twenty inches wide, three-sixteenths of an inch thick, and of suitable length, are placed under the platforms, and by means of suitable gearing their power is concentrated on a shaft, from which it is taken and applied to rotating the journals, the springs uncoiling slowly, but giving a quick rotary motion to the car wheels. One or both springs may be used, as the case may require, and the gearing may be reserved to move the car in either direction, while a governor regulates the speed.

"The car is under the perfect control of the engineer, and it can be stopped and started much quicker than when operated by horses; inasmuch as the power required to stop the car is used to stop it, and the inertia acquired in running is used to stop it, very ingenious mechanism being used to accomplish this result. It is expected that an engine will be used at the end of the route to wind up the springs, an operation requiring about two minutes and a half time, and, when wound, they are supposed to propel a car five miles, carrying sixty passengers. One great peculiarity in the mechanism consists in the fact that the movement of the car down an incline is made to wind a spring, which is used to propel the car up grade."

India Rubber Spring Motor for Street Cars.

The New Orleans *Republican* gives the following description of a new invention made by Solomon Jones and Benjamin Terfloth of that city:

"There is a strong platform, on which the car is to rest, and to this platform is attached the by no means complicated combination of cogs and wheels which, when acted upon by the elastic power of India rubber, moves the car with steady motion at almost any given rate of speed.

"In front, beneath the platform there is a large wheel, called in the specification of the patent the power pulley, among mechanics known as the master wheel. It acts like the drum on which is wound the main spring of a watch. The India rubber being fastened on the under part of the platform, is continued along by being passed around fixed pulleys, of which there are five on each side of the platform; by this means a sufficient length of India rubber band is obtained, the length in a street car of the ordinary size being one hundred and twenty-five feet. By means of a circular lever, exactly like the horizontal to regulate the brakes in ordinary cars, the master wheel is turned, and the India rubber wound around it until that remaining on the pulleys acquires extreme tension. When wound up the contractile power of the India rubber bands will give the requisite motion to the machinery for the propulsion of the car.

"The band of India rubber to be used in propelling street cars, is slightly vulcanized, round in shape, and and two and a half inches in diameter.

"The propelling machinery of the car is provided with a means of reversing its motion, which is acted upon by a lever adapted to the foot; by this means the car can be made to run backwards as well as forwards with equal facility. By means of the circular lever or horizontal wheel used in winding the machine, its speed can be regulated with the utmost nicety. There is no necessity to stop the car in order to wind up the machinery. It can be wound up while at full speed with as much facility as a Lepine watch can be wound up while going."

To this description there is much added which make it appear that the writer supposed that power is created by the use of India rubber, and that nothing more than hand-power is required to wind up the rubber. Of course the rubber is efficient only as a reservoir of power, all which must be obtained from the engine or other motor employed in stretching it. As for winding it up as it moves along, that could be done only by a steam engine on the car, or by a man of something more than two-horse power.

Locomotives for Mines.

Messrs M. Baird & Co., of the Baldwin Locomotive Works, Philadelphia, have built during the present year a number of small locomotives for use in mines, hauling away cinder, &c. The engines referred to are miniature locomotives, adapted to narrow gauges of 2½, 3 or 3½ feet. The Thomas Iron Works, Hokendauqua, the Lehigh Crane Iron Works, Catasaqua, and the Glendon Iron Works, Easton, are each now working two of these

machines for hauling away cinder from their furnaces. At the former establishment the two engines do the work which formerly required thirty mules. The economy of their use is therefore manifest. For out of door work, the little engines are built with outside cylinders 9 inches in diameter and 12 inches stroke; the driving wheels are 30 inches in diameter. For mining purposes the cylinders are placed inside, the extreme width is reduced to about 5 feet and the extreme height five feet 4 inches. When running in the heading of a mine it is intended that coke shall be used as fuel so that little or no smoke or gas will be produced. These engines, in complete working order, with tank of water on boiler and a man on footboard, will weigh only from six to eight gross tons.—*Miners' Journal.*

Davenport Bridge.

Of the eight piers of the new railroad and wagon bridge over the Mississippi between Rock Island and Davenport, four are completed and the fifth is commenced.

Railroad Manufactories.

The Murray Iron Works, of Burlington, Iowa, are increasing their capital stock, and purpose to establish extensive car works in addition to their present operations.

A company has been organized for manufacturing pig iron rails, and other iron in Struthers village, Poland township, Mahoning county, Ohio. It is called the Struthers Iron Company.

A rolling mill at Portsmouth, Ohio, is expected to resume work soon and manufacture railroad iron.

The locomotive works at Schenectady are employing more hands than ever before.

A new rolling mill is to be built at Greenville, Pa.

The new hammer in the Bessemer Steel Works, at Harrisburg, Pa., weighs 35,000 pounds, and cost $92,000, and is the largest in the United States. The company soon expect to make 25,000 tons of steel rails per month.

The Jordan Rolling Mills, at Allentown, have been sold to the Glee Iron Company for $140,000, and work has been resumed there.

The Jackson & Sharp Car Works.

The Jackson & Sharp Company, located in Wilmington, Delaware, employ 475 hands, and their pay roll per week amounts to $6,000. They have just completed an extensive addition to their large works and contemplate enlarging further this fall. Their works now contain six Pullman Palace cars, two of which are nearly completed. These are named the "Baltimore" and the "Wheeling," and are intended for the Baltimore & Ohio Railroad. They are build after recent plans by Mr. Pullman and for beauty of design and workmanship cannot be excelled.

They have completed ready for shipment a number of fine first-class passenger coaches, and mail and express cars for the St. Louis & Southeastern Railway and have a large number well advanced and orders on hand for the Dunkirk, Warren & Pittsburgh, Logansport Crawfordsville & Southwestern, Oil Creek & Allegheny River, Mississippi & Tennessee, Charleston & Savannah, and other roads. Their machinery is of the latest and most approved style and they are prepared to do a very large amount of work.

REGISTER OF EARNINGS.

FOR THE SECOND WEEK IN AUGUST.

Cleveland & Pittsburgh (203 miles) 1870	$57,180 70
" " (203 miles) 1869	52,025 73
Increase (10 per cent.)	$5,154 97

FOR THE THIRD WEEK IN AUGUST.

Chicago & Northwestern (1,157 miles), 1870	$277,639 00
" " (1,157 miles), 1869	234,129 00
Increase (18½ per cent.)	$43,510 00
Chicago, Rock Island & Pacific (608 miles), 1870	$147,000 00
" " " (594 miles), 1869	134,897 00
Increase (9 per cent.)	$12,103 00
Milwaukee & St. Paul (936 miles), 1870	$134,697 00
" " (825 miles), 1869	118,551 00
Increase (13¾ per cent)	$16,146 00
Pacific of Missouri (355 miles), 1870	$79,345 00
" " (355 miles), 1869	65,629 00
Increase (21 per cent.)	$13,716 00
Des Moines Valley (235 miles) 1870	$22,176 77
" " (102 miles) 1869	18,102 18
Increase (22½ per cent.)	$4,074 59
Chicago & Alton (431 miles), 1869	$143,630 64
" " (465 miles), 1870	124,492 30
Decrease (13 per cent.)	$18,638 34
St. Louis & Iron Mountain (310 miles), 1870	$32,052 00
" " " (310 miles), 1869	17,438 85
Increase (84 per cent.)	$14,613 15

—The enormous increase of business aver the Atlantic cables, caused by the European war, will probably justify remarkably large dividends for the current half year.

Steam Locomotion in Cities.

BY J. K. FISHER.

Eighteen years ago some engineers connected with the New Haven Railway devised a plan by which they were to bring the trains of the three great railways from a common depot in Westchester down to the Battery (New York), and, incidentally, to do a considerable business in carrying city passengers. This is much like the original scheme of the Metropolitan Railway, which was chiefly to bring a great railway into the middle of London: and had this plan been carried out, probably the city traffic would have exceeded all expectation, as it did in London; and become the chief business of the line. Mr. Schuyler applied to the Legislature for a charter for this plan, in opposition to the other plans up at the time.

The general feature of the plan was to run a railway in an open cutting between Broadway, Mercer, and the other streets in line, going under the cross-streets, except Canal street. The scheme was then practicable, the lots being occupied in the rear only by privies, which had been rendered useless by water-closets. But now many of the lots are covered by buildings which would have to be paid for, and would increase the land damages beyond the limits of economy. For Broadway, therefore, this scheme is too late; but between East Broadway and Henry street, and along upward on the east side, there is still room for it; and I believe it the best plan yet proposed.

I do not, however, see the necessity of going *over* Canal street, or any other street, however low, or however deep the sewer may be under it; a dive under such a street is rather an advantage, as is shown in Barlow's plan; provided a proper speed be kept, which, perhaps, would have been inconsistent with their views of freight traffic.

This open cutting, with a few short tunnels under cross-streets, would have been free from the objection that applies to underground plans, that of foul air. The land damages would have been nothing, for the dark offices and stores are really of less use than the light from the open space would have been. But a high speed cannot be got on rails with frequent stops; therefore we may as well think for ourselves whether the railway is unimprovable and eternal, or whether we can reconcile half-mile stations for way traffic with high speed for through traffic.

My plan is to lay iron planes in these open cuttings, and to run steam carriages, which can pass each other, so that the through carriages can run at full speed from end to end of the line, and then run off over the common roads to distribute and take up passengers. I would, as soon as practicable, have separate streets or cuttings for the upward and downward travel, to lessen the danger from collisions; and I would have good buffers on the carriages.

With such provisions, I believe that damages from collisions would be less than on railways. When a locomotive breaks down or is derailed, it plunges into the ground and stops suddenly, and the cars are dashed against it and broken up; but if a carriage on a smooth floor break down, it will slide along until stopped by friction, and no person will be hurt. The sides of the cutting being smooth, there could be no collision except by running against carriages going the same way or standing. But all carriages would turn out of line and get close to their landings before stopping.

There are several advantages which this system would have over the railway system for suburban passenger traffic, in which there must be stations within half a mile of each other. First, the power, and consequently the contamination of the air by gases and steam, will be less. The diminution of resistance caused by rails is neutralized by the increase of resistance caused by the cones and flanges of railway wheels. Harding & Russell's experiments showed the resistance to rolling to be three pounds per ton, and the axle friction the same, at the slowest motion; but as the speed increased, the resistance increased at the rate of one-third pound per ton for each mile per hour. Nicholas Wood's experiments showed resistance to rolling of two and a quarter pounds per ton for pairs of thirty-four-inch wheels rolling down an incline. It seems that when the axles are held parallel the resistance is greater than when they are allowed to move as the cones of the wheels direct them. And on curves the resistance is much increased. If the wheels be larger, the rolling resistance decreases also the axle friction. And cylindrical wheels cause less resistance than conical wheels, even when they roll fairly on the rails; because there is some breadth of bearing on the rails, and there must consequently be slipping due to the different diameters of the parts of the cone that touch the rails. What is the rolling resistance of a cylinder on an iron plane I do not know; but I take it to be less than two and a quarter lbs. per ton, the amount found by Wood for thirty-four-inch conical wheels. But assuming that it is the same, and that the axle friction, in consequence of larger wheels or smaller journals, is also two and a quarter lbs., we have four and half lbs. per ton for the wheel resistance of an iron floor that is as true as rails. And this resistance is constant at all speeds: there is no cause to increase it, except the imperfection of the plane, which is so slight that it could have no sensible effect on carriages with good springs. In confirmation of this, I may cite the general opinion of early railway men that the rolling resistance on rails was constant at all speeds: they were mistaken only because they did not allow for the effects of the cones and flanges, which became greater as the increased speed swayed the carriages sidewise.

The mean speed while running should not be less than thirty-six miles per hour for suburban traffic. At this rate, on rails the resistance would be eighteen lbs. per ton, and on iron floors four and a half lbs. per ton. There would be additional resistance from the air, which would increase as the square of the speed; but this would be less on planes than on rails, because side winds, by pressing the wheels towards the leeward rails, cause them to roll on unequal diameters—an effect that cannot occur on planes. The head resistance may be lessened by making the carriage sides smooth and their ends round or elliptic; and, considering the exemption from the effects of side winds, I think that steam carriages will have much less resistance from the air; and that the combined resistances while running will not exceed a quarter of the resistance on rails.

On stone tracks the resistance is twelve and a half lbs. per ton. I believe it would be the same on the best pavement—or stone floors—in Florence and Naples. There might be a slight increase of resistance due to an increase of speed; but this could be prevented by india-rubber tires an inch thick. I may say, then that on an old-fashioned stone-floored road, such as the Romans used 2,400 years ago, steam can run with two-thirds the power it requires on iron rails, at the speed necessary to economize the time and money of city passengers.

I might go further and show that on a well-rolled macadam road, a steam carriage, in consequence of its lightness, could carry passengears with less power than is expended on rails; Mr. Brydges Adams has said this years ago. But such expositions are not wanted when we treat of city traffic, for which iron is the best and cheapest road material.

Another cause of diminished resistance on plane roads is that carriages run through, or partly through, without stops, whereas railway trains must stop every half mile. Let us suppose that the maximum speed is thirty miles an hour. This contains power enough to lift the train thirty and a quarter feet high; and this power is exhausted in wearing out brakes and wheels exery half-mile, instead of driving the train more than three-quarters of a mile at full speed, as it would do were there no stop. At this rate, if twenty lbs. of fuel per mile will run a through train, about fifty lbs. will be required for a way train that stops every half-mile.—*American Artisan*

An Enormous Steel Casting.

There was cast, on Tuesday, with the most complete success, at Messrs. Thomas Firth & Sons' works, Sheffield, one of the largest blocks of steel ever cast in this country. It is intended, we believe, to form the shaft of the screw of the Doublin Steam Packet Company's vessel, "Munster;" is about fifteen feet in length by nearly four feet in diameter, and weighs over fifteen tons. For some days most elaborate preparations for the operation had been made; and the weather on Tuesday morning was anxiously watched, as, had it rained, the operation must have been postponed. Crucible steel alone being used, the pots had to be brought from all quarters of the works, and rain would of course have tended to cause inequalities in the metal. The work of melting the steel commenced about eight o'clock, in no fewer than *five hundred and forty-four* crucibles—each containing sixty-four pounds—the total quantity thus being 34,816 pounds, or fifteen tons, three-quarters, twelve pounds. About half past twelve o'clock the work of casting commenced, and was a complete mechanical as well as scientific triumph.

With 544 crucibles to empty into one mould, the difficulty of procuring a steady flow of metal at an equal temperature was, as may be imagined, very great; but so admirable were the arrangements, and so enthusiastic was the interest which the workmen individually took in the process, that in half an hour it was triumphantly accomplished, without the slightest flaw or accident. The scene was a striking illustration of the order and method which should ever prevail in a large establishment. The motto of those in charge was, evidently, "A place for every man, and every man in his place." Silently, and almost noiselessly, the stream of workmen approached with the crucibles, and as silently retired in the opposite direction when the mould had received the appointed quantity of molten metal, till one could not resist the idea that he saw before him the results of military training. No battalion of French or Prussians could have performed their dangerous and fatiguing task with more steadiness, precision and care; and we believe Mr. Firth, who was himself present superintending the work, expressed his extreme satisfaction with the splendid manner in which the workmen had done their duty. Not a single crucible was upset; not a single flaw occurred in the metal; not a single hitch occurred in the order of time in which every crucible required to be emptied.

We do not know whether the rules of Norfolk Works permit those of the public who may be interested in such triumphs of engineering skill—for they are really entitled to such a designation—to pay them a visit; but we are certain there are many who would be much gratified by witnessing such a magnificent casting. Descending to the subterranean part of the workshop, where the iron mould stood free, the effect was grand in the extreme. The mould, which was about four feet in diameter, had, of course, been heated by the steam to a brilliant white, and the mighty mass of glowing metal, in such a strange and cavernous place, looked in very truth like "a pillar of pandemonium." A popular idea of the magnitude of the casting may be realized, when we state that, some ten or twelve years ago, the correct casting of an ingot of fifteen cwt. of crucible steel was considered as great a triumph as that of fifteen tons on Tuesday now is! The weight of an ordinary crucible steel ingot is only about forty-five pounds, between which and fifteen tons there is a slight difference. There were nearly 300 men engaged in the work of casting.—*Sheffield Telegraph.*

—Mr. W. S. Spiers, for the past five years Superintendent of an extensive railroad ticket printing establishment in Buffalo, has lately become a partner in the ticket printing firm of W. S. Spiers & Company, of Atlanta, Georgia. The Buffalo *Commercial Advertiser* says that, in the matter of ticket printing, "Atlanta is to the "South what Chicago is to the West."

RAILROAD GAZETTE.

PUBLISHED EVERY SATURDAY.

CONTENTS.

INDEX TO RAILROAD ADVERTISEMENTS.

Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Inventions.—Those who wish to make their inventions known to railroad men can have them fully described in the RAILROAD GAZETTE, *if not previously published,* FREE OF CHARGE. *They are invited to send us drawings or models and specifications. When engravings are necessary the inventor is expected to furnish his own engravings or to pay for them.*

☞ *Our Prospectus and Business Notices will be found on the last page.*

MR. M. N. FORNEY, whom many of our readers will remember as a mechanical engineer of ability and reputation, formerly connected with the Illinois Central locomotive works and other manufacturing establishments, has been engaged as associate editor of the RAILROAD GAZETTE. Mr. Forney will have especial charge of matters relating to engineering and mechanics. In the course of the year he will visit railroad shops and manufactories in many different parts of the country, to confer with engineers and mechanics, observe new structures, machines and processes, and procure information which will be valuable to railroad men. We especially commend him to those whom he may visit.

Mr. Forney's office is at Room 7, No. 72 Broadway, New York.

PROGRESS IN RAILROAD MECHANICS.

The experience of the past in advance of which mechanical science and construction has amply shown that great and strongly marked steps forward come only at quite long intervals and that the years intervening between these successive steps are filled up by the slow and painstaking development of the details of the machine or process which may thus have been specially pushed forward.

It often occurs, too, that such a step in one process or method leads to equally noticeable movements in others dependent more or less upon the the first. The gradual perfecting of the screw propeller for steam ships furnishes an illustration of this principle, for, as soon as the fact was actually established that a screw would drive a vessel, many minds were turned to the problem of discovering the best form, not only of screw, but of vessel and of engine in connection with which it should be used. The progress which has been made in this working out and perfecting of the principles and details of this adaptation of the screw has perhaps its best illustration in the fact that one of the finest and latest built side-wheel ships has been found unable to maintain itself, commercially, in comparison with the screw ships of the same line, and it has recently been transformed into a screw steamer.

The railroad system of works and machinery, nearly the world over, is another instance of the gradual progress toward perfection which all such works undergo, while waiting for some marked advancement, and in which it may with truth be said that in point of newly developed *principles* we are little in advance of the very pioneers of railroads. The multitubular boiler with an internal fire box, the use of the exhaust steam for inducing draft through the fire, the smooth tread driving wheels, and a steam pressure vastly above that in common use in their boilers were all adapted to the locomotive by its earliest constructors; and we of later years have hardly progressed beyond them, save as our gradually improved machinery has enabled us, with its skilled attendants, to make of larger size and at less cost those parts which at the first were made only with serious difficulty.

The fact that steel is by far the best material for locomotive fire-boxes seems to have been established almost all at once, and now steel makers are striving to bring up the details of their manufacture or that such steel, called for so suddenly, may be made at the lowest possible cost.

The introduction of seamless tubes, although dating many years back, was in its time another illustration of this general law, and it relieved builders from many petty difficulties.

Such instances of important sudden advance are much more numerous in respect of the lesser details of railroad practice than of general form and efficiency; and in this last particular it is hard to say what changes may be looked for with the most confidence.

It is certainly safe to say that a reduction of dead weight in all parts of the rolling stock of our roads, and still more of the load on each pair of the wheels of our locomotives, would do more to advance the credit side of railroad accounts then any other thing beside, and experience would seem to indicate that only by means of some radical step or advance the needed improvement will sooner or later come, to the surprise of everyone bringing the help needed, to lift the burden which has long rested on all our roads, and upon some with a well nigh crushing weight.

One very important step in this special direction is the quite promising introduction of the Fairlie locomotive in which, within the cubical space that for any assumed gauge an engine can occupy to good advantage, a sufficient weight can be concentrated to insure the handling promptly of trains nearly or quite twice as heavy as can now be commonly drawn, and in which this weight is so distributed on six pairs of wheels that the destructive blows dealt upon the joints of the rails are greatly lessened in intensity, and the reflex strain upon the wheels, springs and other parts of the engine is equally reduced.

The use of steel does not seem as yet to have caused any material reduction of the dead weight that must be hauled in every train. The chief good it has accomplished has been to insure greater safety of working in those parts for which it has been used, with but slight decrease of their size and consequent weight. The use of iron in freight cars has given no favorable result in a reduction of weight as they have been designed heretofore, and in just what form they will be made in the future is a problem of no small interest and importance. Whether anything would be gained by some radical change of form, as adapted to some particular use or class of freight, is one of the questions that some one doubtless will solve suddenly some day, and many will then wonder that it never had been solved before.

Thus illustrations of this general law might be multiplied, not only in railroad matters, but also in many other branches of technical science; but the fact that great inventions come rarely, and it falls to most men only to work up and work out details of that which others have originated, should never be allowed to deter any one from that careful observation and attentive research which have almost invariably characterized the men at whose hands the great inventions of past years have been brought to the notice of the world.

The General Ticket Agents' Excursion.

It is announced that the excursion party of general freight, ticket and passenger agents will leave Omaha for San Francisco on Tuesday the 10th inst. It is probable that most of the roads of the country will be represented, and there is every reason to anticipate a very pleasant journey. The trip mentioned will be made somewhat leisurely, affording an opportunity to visit places of interest. Coming eastward the party will be taken by a fast train which will bring them to Chicago on the 27th inst., in time for the General Ticket Agents Convention, which will be held the next day.

St. Louis and The Kansas Pacific.

In an article on the opening of the Kansas Pacific Railway to Denver, the Chicago *Tribune* says that the new road will be a great convenience to St. Louis, and that "it shortens the distance between that city and San Francisco." The distance from St. Louis to San Francisco is 72 miles greater by Kansas City and the Kansas Pacific than by Omaha and the Union Pacific. Moreover St. Louis has never lacked a short route to the Union Pacific. Its connection is made, it is true, over the lines of several different companies, but a through passenger train has run between St. Louis and Council Bluffs for many months, passing on the North Missouri Railroad to Macon, the Hannibal & St. Joseph to St. Joseph, and the Kansas City, St. Joseph & Council Bluffs (lately the St. Joseph & Council Bluffs) to Council Bluffs. This route is but 437 miles long, which is shorter by 53 miles than the shortest route between Chicago and Council Bluffs. It is true that there are several trains daily from Chicago to Council Bluffs, and but one from St. Louis; but we believe that St Louis has accommodations for all passengers. It has few trains because it has few passengers, and not few passengers because it has few trains.

But the Kansas Pacific does afford a better route between St. Louis and Colorado. To Denver the distance from St. Louis by the Kansas Pacific is 902 miles. By Omaha and the Union and Denver Pacific roads the distance between these places is 1,069 miles. The distance from Chicago to Denver is 1,114 miles by Omaha and 1,128 miles by Kansas City. So far as distance is concerned, therefore, St. Louis has now a considerable advantage over Chicago. But as Chicago, so far, has been able to secure the largest part af the trade of Kansas, though the distance to St. Louis is less by three sevenths, it will hardly give up its Colorado trade because St. Louis is nearer by one-fifth.

The Chicago & Northwestern Report.

The annual report, which we present in this number of the RAILROAD GAZETTE, was received so late that we are unable to do more than barely call attention to it in our editorial dolumns. Doubtless nothing more will be needed, for the interest taken in the report by all railroad men will be so general that they are sure to read it for themselves so soon as they have learned where they can find it. The large falling off in earnings of more than ten per cent. is due to the decrease of business on the Wisconsin Division occasioned by light crops, poor prices, and the diversion of business to Milwaukee, and to the cessation of the movement of material over the Chicago & Council Bluffs line, owing to the completion of that road. The operating expenses on the Wisconsin and Iowa divisions amounted to nearly three-fourths of the gross earnings. With the strictly economical policy now enforced and the large business probable the current year, the next report will doubtless give a much more satisfactory exhibit.

But the earnings of the last year make a bad showing only when compared with those of the previous year. They were a little larger than those of the year 1867-68, and were exceeded only once in the history of the road.

The Kansas Pacific Excursion.

A large excursion party, including prominent railroad officers and journalists, left St. Louis last Tuesday for a trip over the newly completed Kansas Pacific Railway. A party from Chicago went by the Chicago & Alton Railroad to St. Louis in the new Pullman commissary car "Gem," which has just been built at the Chicago & Northwestern shops, in this city, by Hugh Grey, the Master Car Builder. C. N. Pratt, the Chicago agent o the North Missouri, and A. B. Pullman, of the Palace Car Company, had charge of the party. The train from St. Louis consisted of ten Pullman cars, the sleeping cars "Cheyenne," "Dexter," "Wayne," "Ogden," and "Hannibal," the commissary cars "Gem," "Ruby," and "St. James," a smoking car with wine room and hair-dressing saloon, and a baggage car.

—A party of sixty ladies and gentleman sat down to a banquet at the Southern hotel in St. Louis on the evening of the 30th ult., on which occasion Henry Roberts, General Agent of the Rockford, Rock Island & St. Louis Railroad on behalf of the officers of the road and friends present and absent, presented to E. Sweet, Jr., their Chief Engineer, a valuable Jurgenson watch and chain worth $500.

Chicago Railroad News.

Pittsburgh, Cincinnati & St. Louis.

The success of the fast train running over this and the Pennsylvania road to New York in twenty-seven hours is one of the most remarkable features of this season's business. When we consider that nearly 90 miles of the run had to be made over the Camden & Amboy's line, which could not be induced to run much more than twenty miles an hour, and moreover, that the 355 miles between Pittsburgh and Philadelphia have very heavy grades, this time seems really wonderful. Yet it has been maintained with the utmost regularity and scarcely a failure to make time for more than three months, and has been as safe as any train on the line, no accident worth mentioning having occurred. Moreover, it has become so popular that it is usually crowded. Four cars the other day brought to this city 181 passengers, and the train is almost always full and often crowded. Certainly the roads of this line have satisfactorily demonstrated their ability to make fast time.

Chicago & Northwestern.

The Baraboo Air Line has been located from Madison as far as Lodi, about twenty miles northwest. It passes along the east side of Fourth Lake. A new line will be constructed for two or three miles south of Madison, giving the road an independent entrance into that city. Heretofore it has formed a junction with the Prairie du Chien line of the Milwaukee & St. Paul road about a mile from the city, and entered the town on their track. A large amount of grading will be completed this season and perhaps some tracklaying.

The revival of business on this road is most satisfactory. The earnings for August show an increase of about $200,000 over those for the same month last year, and this increase more than counterbalances the decrease for the other two months of the fiscal year. With the large crops of the past harvest, the fair prices offering, and the general prosperity of the country, it is quite possible that the earnings of the current year may equal those of 1868-69, when nearly a million was received for hauling material for the Union Pacific Railroad.

The Winona and St. Peter Railroad was completed to both Mankato and St. Peter this week, and this line has now 145 miles of road through one of the most productive wheat countries on the globe, most of whose exports it will deliver to the Northwestern. An extension of this road will be made to New Ulm, whether from Mankato or St. Peter is not yet determined. This extension may be commenced this fall.

Chicago & Alton.

The Louisiana connection has been finally located to Whitehall, which is nearly due east of Louisiana. The contract for constructing this line has been let to Messrs. Shepherd & Co., who are bound to complete it by the 1st of March next. This firm constructed the line from Dwight to Streator.

Illinois Central.

The company will probably take possession of the Iowa Falls & Sioux City Railroad, between Fort Dodge and Sioux City and have trains running through from Dubuque to Sioux City before the end of this month. This completes the company's Iowa lines. But it is hoping to make the Cedar Falls & Minnesota Branch more profitable by an extension through Minnesota from the present terminus of that line at the State line northward to St. Paul, thus rendering it independent of the Milwaukee & St. Paul, and giving it a share of the traffic of a very productive wheat country, already well settled and cultivated. Engineers have examined the route from Mona through Mantorville and Cannon Falls to St. Paul and find it in every way promising. Towns on the line are offering aid liberally, and it is not impossible that the Illinois Central will have a line to St. Paul before the end of next year.

At the other extremity of their line in Southern Illinois, a valuable connection will soon be acquired by the completion of the Belleville & Southern Illinois Railroad to Duquoin, thus opening a very direct route between St. Louis and Cairo. This road will probably be completed by the 1st of October.

The company's business, especially in freights to Chicago, is now very large, as grain, both corn and wheat, is coming forward freely.

Fearful and Wonderful.

The third and last wonderful game of base-call of these now famous clubs will be played this afternoon at Sharpshooters' park on the Pittsburgh, Cincinnati & St. Louis Railway, sixteen miles south of the city. The trains will leave at one o'clock, and accommodations will be provided for ladies, who are expected to be present in numbers to adorn the grounds and inspire the players. The cards of invitation issued for this game are unique. Two players are represented, one proportioned like Don Quixote and the other like Falstaff, (both of whom can be recognized by those familiar with the faces and figures—especially the figures—of the railroad men on Clark street). Between them is a huge red ball, considerably higher than either of the players.

Personal.

Charles B. Foster has been appointed Ticket Agent of the Chicago, Burlington & Quincy Railroad at the Central Depot in this city. Mr. Foster has been for nearly five years employed in the ticket office of the Michigan Central Railroad in this city, under Mr. Wentworth, and is a very capable, trustworthy and deserving man, whom every one is glad to see promoted. Mr. H. W. Hubbell, whom Mr. Foster succeeds, is now dangerously sick with a pulmonary disease at his home in Aurora. He had held the position but a few weeks when compelled to retire. We are glad to hear that his condition, for some days, has been improving.

D. W. Hitchcock, long agent of the Burlington & Missouri River Railroad at Omaha, and since last spring agent of the Chicago, Burlington & Omaha line on the Pacific coast, with headquarters at San Francisco, was in the city last week, but started for the West on Wednesday.

Mr. W. C. Cleland, the General Western Passenger Agent of the Pittsburgh, Fort Wayne & Chicago Railway (and one of the most efficient in the profession), left Chicago for the Pacific coast yesterday, to look after the business of his line. He will probably be absent about three weeks.

Freight Rates.

There has been no change on rates westward since last week, when first-class was made $1 from New York to Chicago. But several changes have been made in eastward bound rates, all upwards. The last tariff we have obtained gives the rate at just about the ordinary fall and spring standard. It is $1.60 on first-class, $1.25 on second-class, 85 cents on third-class, and 50 cents on fourth-class and grain in bulk. Rates to Boston are ten cents more on first and second classes and five cents more on the other classes.

These rates will probably be maintained if rates by lake are kept firm; but if the vessel rates drop, we may expect rail rates to follow suit. We believe that there is a quite satisfactory movement eastward at the increased rates.

Live Stock to the West.

We do not often have such instances to notice, but this week a movement has commenced which we must chronicle. In the baggage car of an express which left Chicago for Council Bluffs on the Chicago & Northwestern Railway one day last week, there were *eleven dogs*. Six of these belonged to a party of railroad officers who were going to hunt prairie chickens in Western Iowa. Two of them were shipped to San Francisco, one to Japan, and two to Australia. The five last named came from England, we believe, and are for the use of English sportsmen on and beyond the Pacific.

NEW PUBLICATIONS.

The St. Louis Journal of Commerce which comes to us in place of the St. Lous *Journal of Commerce and Mississippi Valley Review* is so transformed in appearance that its best friends would not know it. However valuable the old paper, it could not be called beautiful. Indeed, we think we are justified in saying that as a specimen of typography it was simply atrocious. But it is now as much distinguished for beauty as it formerly was for ugliness. It has thirty-two quarto pages, a little smaller than those of the RAILROAD GAZETTE, printed most beautifully on fine and heavy paper, so that it has scarcely any superior in appearance among American journals, being quite as handsome as (and very like) our beautiful Chicago quarto monthlies, of which the *American Builder* and the *Spectator* are examples.

The new paper in its contents is much like the old one, having a variety of articles on commercial and economical subjects, and a great deal of commercial, manufacturing and railroad news. It pays especial attention to manufactures, and devotes a large part of its space to the advocacy of the doctrines of protection. This journal is published weekly in St. Louis by Wolcott & Marmakuke at $5 per year.

The Telegrapher, a journal "devoted to the interests of the telegraphic fraternity" entered upon its seventh volume with the last number, and at the same time appeared adorned with a new and handsome dress. Mr. Frank L. Pierce, a well known electrician and telegrapher is attached to the paper as associate editor, and altogether it promises to be even better in the future than it has been in the past as a repertory of news and information relating to the science and art of telegraphing.

Accidents of the Workshops.

On this subject Mr. Frederick J. M. Butt writes to the *English Mechanic* as follows:

As the *British and Foreign Mechanic* is now amalgamated with the ENGLISH MECHANIC I send you the continuation of this subject, which was commenced in the first named journal on July 2, p. 342. It may be as well to give a short resume of the contents of the previous part. The mechanic, always in the midst of moving machinery, or climbing scaffolding many feet from the ground, is continually liable to accidents, and a knowledge of what to do, and what not to do, will be found of very great use. In the first place, where the accident is apparently serious, the clothes of the injured man should be loosened, and he should be laid on a door, or shutter, or a plank. An attempt should be made to discover whether any bones are broken, and if there is profuse bleeding it should be arrested immediately. Where there is a cut or gash, if the blood is scarlet and comes in throbs or jumps we know that it is arterial blood, *i. e.*, comes *from* the heart; bleeding of this kind is stopped by tying a ligature (a narrow strip of linen) between the wound and the heart. But if the vital fluid is of a dark color, and flows steadily in a stream, it is venous blood, and is going back *to* the heart; in this case the ligature should be tied or pressure applied between the extremity of the limb and the wound. After the wound has been well washed, a compress of pyramidal form made of linen rags or lint should be applied, apex downwards, and bound firmly around with a bandage. Before applying the bandage it should be saturated with water, or a little simple ointment placed on the part next the wound. If the gash is long a stitch or two should be passed through the edges with a bent needle and silk,—each stitch tied separately. If the bleeding of the artery be stopped by the pressure of the finger or the ligature, the compress may be dispensed with, and a piece of lint folded three or four times placed over the wound and bound down with a bandage. If the wound is of such a nature that pressure will not arrest bleeding, especially where one or more of the arteries of some magnitude have been severed, more forcible means must in these cases be applied; the offending artery must be sought for, and when found drawn out by means of what is called a tenaculum, which resembles a shoemaker's sewing awl; when this is not at hand a large pin bent, or a pair of tweezers with fine points; may be used. When the artery is pulled forward it should be tied with some thread two or three times double, and if there are others they should be treated in a similar manner. It must be observed that the extremity of the divided artery *nearest the heart* should be secured. After the blood vessels have been tied the wound should be washed, if caused by an instrument covered with foreign matter, or if not it is always well to cleanse it; but allow as little water as possible to enter the opening, for it has a tendency to swell the flesh and increase the gaping, especially if warm water is used. Any piece of glass or dirt may be removed by a dry sponge. When cleansed the edges are to be brought together with a few stitches or adhesive plaster, and a bandage bound round in the ordinary way. This should be removed daily to see whether the wound is inclined to slough or discharge matter; when such is the case what is called the "water dressing" should be resorted to—this is merely the bandage or rag covering the part to be saturated with water. In some cases "proud flesh" may form; then, as in sloughing, a little nitrate of mercury ointment may be applied. It is best, on the whole, not to meddle with the dressing wound more than to keep it clean, which is a great thing, for it must be borne in mind that the best healing doctor in the world is nature, she can and does perform what no human being can or ever will, and the surgeon's motto is to assist and not interfere or interrupt nature. When it is found that the edges have adhered to each other the stitches may be removed, also the bandage, and a little simple ointment applied on some lint or linen rag, which will prevent the part being injured by dust and other irritating matter, and assist in healing the wound by excluding the air. The cause of wounds being irritated and prevented from healing through not being excluded from the air is from the fact that the atmosphere is impregnated by millions of minute invisible animalcula which is so elaborately explained in Professor Tyndall's lecture on "Dust," which I should advise all my readers to obtain. This *savant* has demonstrated beyond all reasonable doubt that were it possible for all the air we breathe to pass through a filter of cotton wool before entering our lungs that life would be prolonged many years. In proof of this observe the advanced age to which farm laborers live to what those do who are living in the foul air of our great cities. But I am going from my subject, though I could write many pages on what I have just alluded to, but it would be turning from the path upon which I have set out.

Other means are to be adopted when the hemorrhage is obstinate, such as the application of ice or very cold water to the part. Cold is one of the best stiptics we have, and seldom fails to do good; it not only contracts the gaping mouths of the arteries but also those of the wounds, thereby arresting bleeding. The ice can be applied directly to the wound, if clean, or be wrapped in flannel or a piece of linen rag, and on the cessation of the flow the wound bandaged as before directed.

Cases have been known where the artery has only been partially severed; in such instances contraction is impossible; therefore it is necessary to complete the division with a lancet. This should be left for a medical man to do, for it is an operation that requires a knowledge of the venal and arterial system. It should on no account be attempted by a novice, unless medical aid is unprocurable, and this appears the last resource to save the persons life by stopping the bleeding. This is founded on the known tendency of arteries to self-contract on division. The danger in this operation is that an inexperienced hand may, instead of completing the division in the already wounded vessel, injure others in the act, and so, in trying to do good, do a great deal of harm, and make matters worse than before. The safest and surest mode of arresting hemmorage, when the wound is of some magnitude, is by tying the blood-vessels; this, when effectually done, is unsurpassed by any other means relating to external bleeding. It should be borne in mind that *all* the arteries must be secured, else bleeding may proceed after bandaging, and the patient unconciously lose an alarming amount of blood.

—We announce elsewhere that the St. Louis, Vandalia & Terre Haute Railroad is now operated by the Terre Haute & Indianapolis Company, and give therewith the the general officers of the line. All these are old officers of the roads mentioned, with the exception of Mr. Nathan Stevens, who for a year and a half past has held the position of General Western Freight Agent of the Pittsburgh, Cincinnati & St. Louis Railway (Pan Handle route) in Chicago, previous to which he was for a number of years identified with the Pennsylvania Railroad interests in St. Louis. He is therefore no stranger to the field into which he is again called to work.

—It is reported that the Georgia Legislature on Monday and Tuesday last voted to railroad corporations State lands valued at nearly $85,000,000. But as this sum would probably buy nearly half the land of the State at the market price, we presume that this is an overvaluation.

CHICAGO & NORTHWESTERN RAILWAY.

Annual Report for the Year Ending May 31, 1870.

PRESIDENT'S REPORT.

The following in the report (with some omissions) of John F. Tracy, the President of the company.

The following report of the general affairs and condition of the Northwestern Railway Company, and the earnings and expenses for the eleventh fiscal year, ending on the 31st of May, 1870, has been prepared from the books and accounts of the company, and is respectfully submitted to the stockholders:

The gross earnings realized from all sources were:—

From Passengers	$3,799,257 80	
" Freight	8,187,597 10	
" Express	256,677 84	
" Mails	173,306 40	
" Miscellaneous	118,589 07	
		$12,535,428 21

The operating expenses and taxes for the year were as follows:

Operating expenses, (60 68-100 per cent. of earnings)	$7,606,631 51	
United States, State, county and town taxes, (3 25-100 per cent. of earnings).	406,685 83	
		8,013,317 34
Amount of earnings, less operating expenses and taxes, were		$4,522,110 87
Deduct the following items chargeable to the year's business, viz:		
Interest on Funded debt	$1,111,995 50	
Interest and exchange	5,747 29	
Sinking funds on bonds	45,120 70	
Dividends on Chicago & Milwaukee Railway stock	1,698 60	
Rent of leased roads in Iowa	1,043,692 24	
		2,208,253 63
Leaving net income for the year		$2,313,857 24

The disposition of this amount is shown in the following statement of accounts:

INCOME ACCOUNT.

Amount to credit of income account, May 31st, 1869	$1,914,655 50
Net earnings, for year ending May 31st, 1870	2,313,857 24
	$4,228,512 74

From which deduct

DIVIDENDS

as follows:

Dividend of 5 per cent., free of tax, on preferred stock, paid June, 1869	$900,510 00	
Dividend of 5 per-cent., free of tax, on common stock, paid June, 1869	732,445 00	
Dividend of 5 per cent., less tax, on preferred stock, paid Dec., 1869	930,458 50	
Dividend of 4 per cent., less tax, on common stock, paid Dec., 1869	556,700 00	
Government tax on dividends	180,266 05	
	$3,300,379 55	
Also, dividend of 2 per cent., less tax on preferred stock, for the half year ending May 31, 1870	386,608 90	
		3,687,088 45
Balance to the credit of income account, May 31, 1870.		$541,424 29

The dividends declared from the earnings of the year will be seen to amount to seven per cent. on the preferred and four per cent. on the common stock, leaving a surplus of $541,424 29 at the close of the year, as represented in the general balance sheet published herewith.

FUNDED DEBT.

There has been a reduction in the various classes of bonded debt amounting to the sum of $2,142,500.

Total amount of bonded debt, May 31, 1869	$17,290,400 00
" " " " May 31, 1870	15,147,900 00
Difference	$2,142,500 00

The whole amount of bonds retired during the year was $3,059,500, and the amount of bonds issued, $917,000.

CAPITAL STOCK.

The capital stock of both classes, on the 31st of May, 1870, was $35,046,922.82, including the amount of $1,500,000 of preferred stock authorized to be issued by the Board of Directors of the preceding year, to wit, on the 26th of May, 1869, as stated and explained in the last annual report.

The account of common stock stands at	$14,676,629 40
" " " preferred " "	20,370,293 42
Total, May 31, 1870	$35,046,922 82
Total, May 31, 1869	31,249,259 03
Increase	$3,797,663 79

Which is accounted for as follows:

Preferred stock issued (as above stated) July 1st, 1869, pursuant to resolution of the Board of 26th May, 1869	$1,500,000 00
Preferred stock issued for consolidated bonds converted	2,105,000 00
" " " " Peninsula " "	77,500 00
" " " " Chicago & Milwaukee Railway stock exchanged	12,580 00
" " " " settlement of old claims	16,360 00
Common " " " Beloit & Madison stock exchanged	2,360 00
" " " " Peninsula bonds converted.	77,500 00
" " " " settlements and adjustments of old accounts	6,463 79
	$3,797,663 79

The total of bonds and stock outstanding is as follows, viz:

Amount of bonds	$15,692,100 00
" common stock	14,676,629 40
" preferred stock	20,370,293 42
	$50,739,032 82

The convertible privilege attached to the consolidated sinking fund bonds was largely availed of up to the first of May last, at which time it expired by its own limitation, on all outstanding bonds of this issue.

Payments were made during the year of 10 per cent. equipment bonds, to the extent of $550,000, leaving a balance of $825,000 of these bonds to be retired at maturity in three equal semi-annual payments, expiring November 1st, 1871.

The effect of these payments is to release from the operation of the equipment mortgage a large and valuable equipment of engines and cars, which have been fully maintained, now held under the trust deed, costing $2,750,000, and to revest the same under the lien of other existing mortgages, thereby adding to their value, and especially enhancing the security of the consolidated sinking fund bonds.

The decrease in net earnings from those of the previous year amounted to $1,252,213.02, a large share of which was immediately due to the unexpected falling off in business which attended and followed the period of the harvest of 1869. During the months of August, September and October of that year, the decrease amounted to $614,059.63, or to nearly one-half of the entire net losses of the fiscal year.

The decline in the prices of grain, consequent upon the limited demand at the seaboard for consumption and export, and the general disturbance of business throughout the country resulting from unsettled values of all kinds of merchandise, the violent fluctuations in gold in September last, and the depressed condition of trade, effectually checked those commercial operations which ordinarily give activity and abundance to the shipments of grain and other products along our lines before the close of navigation.

The effect of this state of things was felt far into the winter and spring, during which time the company sought to encourage shipments by accepting lower rates for freight, and as a consequence received less revenue from the same amount of business than accrued from the business of a corresponding period in the preceding year.

Added to these conditions—which to a greater or less degree affected the earnings of all the lines, and in many instances augmented the cost of operating, by the preparations which were made for business that was not realized, and by increase and unstable prices of supplies—there were other and exceptional causes which are referred to in detail in the General Superintendent's report, published herewith, that particularly affected the earnings of the respective divisions of the road.

The business of the Milwaukee and Madison divisions showed but little change—there being a slight increase in the number of passengers, and a decline of less than three per cent. in gross earnings on the Milwaukee Division; and a loss on freight and passengers, amounting to $10,168.48 for the year, on the Madison Division.

Compared with the previous year, there was a considerable loss in earnings, mostly from a decrease in freights, on the Wisconsin Division. This is partly attributable to the short crops, which afforded less transportation than was anticipated for distribution among competing lines, whether by rail or water: and partly to the increased activity of other railway lines, whose success more directly depended upon concentrating their efforts on this field of competing traffic, and in securing to themselves a large share of the transportation of Minnesota and Western Wisconsin, The completion and connection of our system of roads with the Winona & St. Peter and the LaCrosse, Trempealeau & Prescott railroads owned by this company, will place us in a more favorable position to secure an increase from these sources in the future.

Reference is made by the General Superintendent in his report to the great amount of transportation of construction materials which ceased with the completion of the Union Pacific railroad, causing a large decline in the receipts of the Galena and Iowa Divisions. This item of business was of course exceptional and temporary, and as large as it was, the belief was entertained that a sufficiently compensating business would spring up soon after the opening of the Pacific line to offset its loss. The through business, together with the natural increase of local traffic, will at no distant day justify this view, and exceed all former earnings; but the early completion of three other competing lines to Council Bluffs and Omaha during the last year, at a time of unusual stagnation in the trade of California, had divided up the through traffic as fast as it was developed, among the four eastern and southeastern lines now converging at Council Bluffs. This company, however, retains its legitimate share of the traffic, and with its facilities, directness, and important position, must continue to command its full proportion of the business.

The Peninsula Division, occupied chiefly in the transportation of iron ore, is in a prosperous condition, and its business steadily increasing. The peculiarity of this service requiring large expenditure and outfit for earning in a few months, during lake navigation, almost the entire revenues of the year, might, under, less favorable circumstances, justify higher rates for transportation than are now charged for it. Taking into account the increased wear and tear of so short a season, and the natural deterioration during the balance of the year of the large equipment excusively employed in this trade, it is gratifying to know that the demand for Lake Superior ores assures a degree of permanence to the business essential to the prosperity of this division.

Sixteen miles of railroad have been constructed and put in operation by the Winona & St. Peter Railroad Company, from Waseca to Janesville, Minn., during the past year, making 121 miles of that road now completed west from Winona, under the auspices and control of this company. A further extension of about 25 miles to Saint Peter, including a branch to Mankato, will be made the present season, which will open up still further a fine prairie country, and passing through the belt of the Big Woods, near the central portion of the State, to the Minnesota River, will intersect the Saint Paul & Sioux City Railroad and reach a commanding position, to draw from these sources, and from the rich, productive and older-settled counties tributary to the valley of the Minnesota River, a large accession of business.

In connection with this work, progress has been made in preparing the La Crosse, Trempealeau & Prescott Railroad for the rails, and it is in contemplation to complete this line the present year, from Winona to the Milwaukee & St. Paul Junction, near La Crosse; thus forming, with the Winona & St. Peter Railroad, a continuous line, extending from St. Peter, Mankato and the Minnesota River Valley, at the west, to Milwaukee, Chicago, and their connections at the East.

Since the publication of the last annual report, the company has brought to successful termination most important and protracted negotiations, set on foot in 1868, for the modification of the terms of the lease of the Chicago, Iowa & Nebraska Railroad, which embraces 81½ miles of our line, between Clinton and Cedar Rapids, in the State of Iowa.

This lease, which is in perpetuity, was made by the Galena Railroad Company before consolidation, and fixed the amount of annual rental to be paid by the Chicago, Iowa & Nebraska Company at 47½ per cent. of the gross earnings of its road. From limited earnings as a local road, paying a moderate yearly rental, the business has grown to large proportions, yielding to the lessors correspondingly large returns for the use of the property. At the same time it has been necessary to keep pace with the growth of business by increased equipment and material improvements, and considerable expenditures have been incurred for these purposes. Within the last two years a superior and substantial iron bridge, combining in its different sections the merits of the best iron bridges in the country, has been built in place of the old wooden structure across the east channel of the Mississippi River, connecting this division with the Illinois shore.

In view of these facts, this company felt warranted in urging upon the Chicago, Iowa & Nebraska Company a concession in the terms of rental, as being not only equitable and necessary, but best calculated to promote the ultimate interests of both parties, and the development of additional business in the future. This result has been amicably attained, and a permanent reduction of the rental to 37½ per cent. made, to take effect from and after December 1st 1869. The saving for each year in the future will amount to a little more than 23½ per cent. on the rental required to be paid under the original lease.

The permanent improvements, new equipment, extensive renewals and through repairs put upon the road during the year, and referred to in the report of the General Superintendent, have preserved the road and rolling-stock in good condition, enlarged their capacity for an increased business, and been ample to maintain the value of the property.

SUPERINTENDENT'S REPORT.

The following is the report of the General Superintendent, George L. Dunlap, slightly condensed:

I submit with this the following statements, showing in detail some of the results of the operations of the road in this department, for the twelve months ending May 31, 1870.

EARNINGS.

The earnings from passengers were—			
	1st class passengers	$3,338,489 87	
	2d " "	287,664 25	
	Excursion "	62,140 98	
	Commutat'n "	110,962 70	
			$3,799,257 80
" Earnings from freight			8,187,597 10
" " " express			256,677 84
" " " mails			173,306 40
" " " miscellaneous			118,589 07
			$12,535,428 21
Whole number of passengers carried			2,276,543
Number of passengers carried one mile			115,457,459
Whole number of tons of freight carried			2,232,978
Number of tons of freight carried one mile			204,747,240
Average earnings per mile of the road			$10,343 80
Total number of miles run by engines			5,913,288
" " " " cars			63,831,406

OPERATING EXPENSES.

The operating expenses are 63 93-100 per cent. of the gross earnings, and with taxes, amount to $8,013,317 34.

The following important items, exhibiting some of the improvements and repairs during the past year, have been charged to operating expenses:

REPAIRS.

Repairs of engines	$327,590 84
" cars	127,168 99
" buildings	107,832 50
" bridges and culverts	131,971 03
" track	656,516 21
Total	$1,364,079 57
For loss in adjusting old claims against Insurance Companies for fires in previous years	39,721 50
Amount in all to	$1,403,801 07

Or 16 2-100 per cent. of the gross operating expenses.

CONSTRUCTION.

The following amounts, expended for permanent improvements, have been charged during the year to construction:

For new iron rails, purchased to supply the deficiency between the old 45 lb. and 60 lb. rail, now being laid in Iowa	$419,351 22	
For 313 tons steel rails	45,791 86	
		$465,143 08
For right of way and increased station facilities, including, $104,100 for depot grounds		122,871 33
For construction of new buildings		122,033 08
For proportion of amount expended in rebuilding bridge over east channel of Mississippi River last year; that is, the difference between cost of wood and iron structure		62,697 43
Cost of Indiana-st. viaduct in Chicago		38,180 94
Cost of Halstead-st. viaduct in Chicago		21,5 6 28
Cost of new fences, gates and crossings		19,051,88
Cost of additional side tracks		83,583 42
For amount of discount on securities sold during the year		95,319 26
Total amount charged to construction		$1,030,396 70

NEW EQUIPMENT.

The following additions have been made to the rolling stock of the company during the year, all of which have been charged to new equipment:

	Average cost of each.	Total.	
4 locomotive engines	$13,229 44	$52,9?7 75	
8 first-class passenger cars	6,914 01	55,528 12	
1 second-class " "	3,700 00	3,700 00	
1 mail car	2,933 83	2,933 83	
1 way car	1,873 79	1,873 79	
2 common boarding cars	974 20	1,948 40	
1 extra	10,146 71	10,146 71	
20 box freight cars	825 14	16,502 77	
4 stock cars	799 73	3,198 90	
31 coal cars	625 00	19,375 00	
4 flat cars	672 33	2,689 28	
315 iron ore cars	335 36	105,636 48	
			$276,451 08

Amount brought forward	$976,451 02
Less amount received for cars sold to Pullman Palace Car Co.,	35,000 00
Amount charged to equipment	$941,451 02

The largest items of increase in operating expenses over the preceding year, are in the accounts of repairs of buildings and repairs of track, in which accounts are included large expenditures for improvements of a permanent nature, and for extraordinary repairs, which might in part have been regarded as construction work. The same remark will apply to many items included in the other operating accounts, as is shown fully by the detailed statement of special items included in these accounts, and amounting to some 16 per cent. of the same. Our expenditures for rebuilding locomotives and cars, renewing the Mississippi River and other bridges, renewals and extraordinary repairs upon buildings, and for relaying some 150 miles of track, include the principal part of this amount, and have placed the road, buildings and rolling stock in a good condition of repair and efficiency.

The business of the different divisions of the road was as follows:

EARNINGS—WISCONSIN DIVISION, 314 6-10 MILES.

From passengers	$839,520 41
From commutation	10,976 85
From freight	1,850,357 75
From transportation of milk	17,620 79
From express freights	51,359 46
From mails	39,919 91
From miscellaneous sources	36,837 13
Total	$3,846,535 30
Earnings per mile of road	$9,048 27
The operating expenses and taxes were 72 74-100 per cent. of earnings.	
Total number of passengers carried	594,526
Number of passengers carried one mile	24,979,683
Total number of tons freight carried	602,961
Number of tons freight carried one mile	60,800,349

EARNINGS—GALENA DIVISION, 261 MILES.

From passengers	$1,020,340 09
From commutation	43,529 20
From through freight between Chicago and Omaha	146,762 46
From all other freight	$2,792,846 86
" transportation milk	32,691 48
" express freight	93,804 67
" mails	44,375 04
" miscellaneous sources	64,053 28
Total	$4,238,403 08
Earnings per mile of road	$16,239 09
The operating expenses and taxes were 53 36-100 per cent. of gross earnings	
Total number of passengers carried	748,016
Number of passengers carried one mile	32,235,375
Total number of tons freight carried	855,465
Number of tons freight carried one mile	82,906,626

EARNINGS—IOWA DIVISION, 354 MILES.

From passengers	$1,162,830 25
From through freight between Chicago and Omaha	892,873 47
From all other freight	1,723,209 06
From express freight	63,708 22
From mails	70,719 94
From miscellaneous sources	5,746 94
Total	$3,419,086 90
Earnings per mile of road	$9,658 44
The operating expenses were 74 19-100 per cent. of gross earnings.	
Total number of passengers carried	338,979
Number of passengers carried one mile	33,551,978
Total number of tons freight carried	471,939
Number of tons freight carried one mile	77,754,546

EARNINGS—MADISON DIVISION, 66 6-10 MILES.

From passengers	$73,436 69
From freight	134,731 38
From express freight	4,110 06
From mails	4,877 40
From miscellaneous sources	579 40
Total	$217,714 93
Earnings per mile of road	$3,220 64
The operating expenses were 72 37-100 per cent. of gross earnings.	
Total number of passengers carried	67,588
Number of passengers carried one mile	2,860,398
Total number of tons freight carried	88,242
Number of tons freight carried one mile	3,860,563

EARNINGS—PENINSULA DIVISION, 73 8-10 MILES.

From passengers	$26,946 35
From iron ore	639,208 27
From other freight	50,449 34
From express freight	1,565 90
From mails	4,721 11
From miscellaneous sources	356 00
Total	$723,306 07
Earnings per mile of road	$9,800 90
The operating expenses were 57 34-100 per cent. of gross earnings.	
Total number of passengers carried	10,730
Number of passengers carried one mile	661,635
Total number of tons freight carried	416,180
Number of tons freight carried one mile	26,764,531

EARNINGS—MILWAUKEE DIVISION, 85 MILES.

From passengers	$565,331 31
" commutation	56,456 65
" freight	406,797 29
" transportation milk	
" express freight	43,130 43
" mails	8,700 00
" miscellaneous sources	11,016 33
Total	$1,090,331 93
Earnings per mile of road	$12,827 43
The operating expenses were 52 47-100 per cent of gross earnings.	
Total number of passengers carried	731,777
Number of passengers carried one mile	21,968,390
Total number of tons freight carried	206,735
Number of tons freight carried one mile	13,360,625

A review of the various sources of revenue shows that a large item of decrease in earnings is to be referred to through transportation between Chicago and Omaha, and is accounted for chiefly by the fact that the shipment of construction material for the Union Pacific road (which had been a large item of our earnings for some years past, and amounted to nearly a million of dollars for the year 1868–9) entirely ceased with the close of that year.

The decline in other freights is due both to the great depression of business which has marked the last year at the West, and the fact that it was found necessary, in consequence of the shrinkage of values of all kinds of grain, and in order to encourage and stimulate shipments during the depression, to modify and reduce our tariff rates on some descriptions of freight.

The passenger business has suffered in common with the freight, and from the same general causes. While more active competition has resulted in lower rates, there is an increase in the number of passengers (excepting the Union Pacific business) in the number of tons of freight carried.

On the Wisconsin Division there has been a considerable decrease in freight earnings. This is due to a partial failure of the crops, as well as to the operation and influences of other lines to draw off temporarily a share of the business of upper Wisconsin and Minnesota, which, under just and equitable arrangements, we may reasonably expect to more fully participate in hereafter. The decrease in passenger earnings is partly attributable to the same influences.

Upon the Galena Divisicn, while the passenger earnings and Union Pacific freights have been less than during the preceding year, there is an encouraging increase in local freights, and the prospect of a still larger gain the coming season.

Upon the long line of our Iowa Division the effect of the loss of the Union Pacific transportation has been the heaviest and most immediately felt. At the same time the passenger and local freight traffic on this division has been less affected than upon any other, by the depressed condition of business and the low prices of grain for the past year—the natural growth and development of the country contributing in large part to stay and counteract these adverse influences—and I am led to hope for a marked recovery in business upon this portion of the road.

The business of the Peninsular Division for the year is satisfactory, and its prospects encouraging. Large outlays have been made from time to time to provide ample equipment and special facilities for handling the heavy tonnage with dispatch and economy, in consequence of which the increase in its earnings has been effected with less increase of expenses than would otherwise have been necessary; and the promise of a future large and steady increase of business based upon the fuller development of the iron resources of the country, is gratifying.

The Milwaukee and Madison divisions show a moderate decrease in some items of earnings, attributable to the causes referred to in connection with the other contiguous divisions. The business of the Milwaukee Division is, however, of a kind but little subject to be influenced by the condition of the markets, or other extraneous causes, and may be depended upon in general for a steady increase.

It is gratifying to be able to state that no passenger has been killed or seriously injured, on any of the company's lines, during the past year.

With the development of the vast amount of lands adjacent to our lines, which promises to be quite as marked for the coming year, as for the past; and with the present prospects of the coming crop, with harmonious arrangements which we seek to preserve with the connecting and neighboring roads, and with greater economy in every department of management, it will not be considered too sanguine to say, that the results of the ensuing year will show a great improvement in the condition and business of the company.

LINES OF ROAD.

The following lines were owned, leased, and operated by the Chicago & Northwestern Railway Company May 31, 1870.

	Miles.	Miles.
Chicago to Clinton, Iowa	138.1	
Clinton to Missouri River, (opposite Omaha,)	352.9	
		491.0
(Double track from Chicago to Junction, 30 miles.)		
Junction to Freeport		91.0
Elgin to Richmond		33.0
Belvidere to Madison		67.6
Kenosha to Rockford		72.4
Chicago to Milwaukee		85.0
Chicago to Fort Howard		242.2
Escanaba to Lake Angeline mine	67.9	
Branches and extensions to mines	5.9	
		73.8
Total length of road		1,156.0

TOTAL MILES OF TRACK MAIN LINES.

Main lines as above	1,156.0
Second track Chicago to Junction	30.0
	1,186.0

The Directors elected June 2, 1870, are: John M. Burke, H. H. Baxter, Geo. S. Scott, A. G. Dulman, M. L. Sykes, Jr., Charles R. Marvin, Harvey Kennedy, A. B. Baylis, New York; J. L. Ten Have, Frzn, Amsterdam, Holland; Wm. L. Scott, Milton Courtright, Erie, Pa; R. P. Flower, Watertown, N. Y.; Henry R. Pierson, John B. Turner, Geo. L. Dunlap, Henry H. Porter, John F. Tracy, Chicago.

The general officers are John F. Tracy, President; M. L. Sykes, Jr., Vice President; Albert L. Pritchard, Secretary and Treasurer; Geo. L. Dunlap, General Manager; John C. Gault, General Superintendent; James H. Howe, General Solicitor; M. M. Kirkman, Cashier and General Accountant; J. B. Redfield, Assistant Secretary and Auditor; R. W. Hamer, Purchasing Agent; C. C. Wheeler, General Freight Agent; H. P. Stanwood, General Ticket Agent.

—The Eastern of France Railway Company has organized a staff of 600 platelayers, carpenters, and smiths, to secure the repair of its own and other railways which may be injured during the war. The Eastern of France Company had also undertaken to work such Prussian railways as might fall into the hands of the French; but the victories of the Germans have spared them that trouble.

The East River Bridge.

No enterprise of similar character now in progress in this country is regarded with more interest by engineers and practical workers in iron, than the proposed suspension bridge that is to span the narrow stream dividing this city and Brooklyn. With us the science of bridge building is still in its infancy. Until within the past few years we had no important structures of this kind and although there are now several vast and costly suspension bridges in different parts of the country, we have yet much to learn from practical experience that cannot be learned by a study of such structures in Europe. Our experiments have been uniformly successful in this direction, but each success adds new and valuable facts to our yet limited knowledge of the science of bridge building, and by improving upon former experiences, saves much of the expense and trouble formerly involved in submitting crude and often imperfect ideas to a practical test. In the construction of the new suspension bridge over the lower rapids at Niagara, one third of the total expense of the work was incurred in trying unsuccessful experiments, and in payment for labor which had to be twice performed. For this reason the progress of the work on the East River bridge is watched with interest by practical engineers, as the success of Mr. Roebling's plan will test many new and important principles, and combine, with such improvements as may be considered necessary, the best results of previous experiments.

Although the labors of the constructing engineer have, as yet, attracted but little attention, the work of preparing the abutments between which the bridge is to swing is progressing with surprising rapidity. Thus far, no obstacle has been encountered in carrying out the original plan. In works of this character, requiring the employment of mammoth apparatus and necessitating the initiatory labor to be carried on in submerged chambers, serious difficulties are often encountered. With the East River bridge, however, owing to the careful preparations of the engineer in charge of the work, and the intelligence and skill of the laborers in his employ, no accident has occurred, nor has any impediment been encountered. A glance at the work, as already completed, shows that there are already some five feet of masonry laid upon the caisson, composed of fine-grained Kingston granite, cut in blocks three feet long. These blocks are raised and deposited in place by means of strong derricks, operated by steam power. The process is simple and expeditious, and differs but little from that ordinarily employed in laying foundations, except in the manner of joining the stones by means of insoluble cement. The work of excavating below this structure is steadily progressing, and the bottom of the caisson is already about twenty-three feet below the surface of the water at high tide; but it will be necessary to lower it some nineteen feet more, making the total descent about forty-two feet, although the depth to which it is sunk will depend somewhat upon the character of the soil reached during the progress of excavation. All that is needed is a firm foundation, and when this is reached the caisson will be allowed to settle into its final position. The excavated earth, debris and rock are borne to the surface in large iron basins operated by means of elevating machinery. Over three thousand cubic yards of soil have already been taken out. Under the able supervision of Mr. C. C. Martin, a force of 175 men, divided into reliefs, is kept constantly at work. Eleven engines are upon the premises, six of which are constantly in use in pumping air to the workmen. As the caisson descends the masonry will be laid in successive rows, until the whole structure is complete, after which the air chambers of the interior will be filled with concrete.

Notwithstanding the rapid progress of the work, it will require at least two years to complete the Brooklyn pier. In the meantime, the work of building the New York pier will be undertaken at the foot of Roosevelt street, where the necessary ground has been purchased. The company is composed of enterprising citizens, and is not cramped for want of means. The work is in good hands, therefore, and it is probable that within three years of the present time we shall have between this city and Brooklyn a suspension bridge which, for strength, beauty and simplicity, will far surpass any structure now building or projected in any part of the United States.—*Iron Age.*

—The Toronto *Globe* of the 27th, in writing of the "Canada Carrying Trade," says: The refusal of the "United States Congress to adopt the President's suggestion about modifying their revenue laws, so as to "permit the purchase of foreign built vessels, is telling "favorably upon Canadian shipping. The amount of "wheat shipped from the West for the four weeks ending 13th August was 3,258,000 bushels, of which 1,461,000 entered Canada, and gave our railways, as well as "boats, a profit in its conveyance. To show the change "that is being effected, it may be noted that during the "week already mentioned of this year 32,400 barrels of "flour were received at Montreal, against 22,600 last "year; while there were for the same week this year "brought in 437,000 bushels of wheat against 172,900 in "1869" Commenting on this the New York *Tribune* "says: "New Yorkers must be up and doing, or its "immense wealth, its large importations, its unrivaled "situation for trade and commerce, will not avail "against the greater energy of Philadelphia and Baltimore on the one hand, and the wealth of the English "and the enterprise of the Canadians on the other. "Our merchants should remember that when traffic is "once diverted from a channel, it is a very difficult matter to get it back again. Let us retain all that we "have, and every day reach out after more."

The Capital Invested in Railroads.

When an individual takes a dollar out of one pocket and deposits it in another, it may require an exercise of imagination to satisfy him that anything has been gained by the operation, but, on the other hand, while the dollar is still in his possession he may feel confident that he has lost nothing by the transaction. In a community the same principle prevails, when, by any business operation, dollars are taken from the pocket of one person and transferred to that of another. Individuals may gain or they may lose, but the community loses nothing while the capital remains in the country. It may be demonstrated that the vast amount of capital invested in the railroads in this country has cost the country nothing except what has been paid for foreign iron. Labor in its various forms, skilled and unskilled, is the chief expense of railroads, and the money paid to those who do the work goes into the usual channels of business, and gives life and activity to all the operations of trade. Such an expenditure of capital gives the best encouragement to industry, and so far as it keeps the heads and hands of men employed, it tends to their moral improvement.

The railroads of our country have cost over two thousand million dollars, and except the amount sent abroad for iron, this is a clear addition to the capital of the nation; this vast sum being a creation of the industry and enterprise of those engaged in this work. It is estimated that the enhancement of the value of property resulting from the construction of railroads is, on an average, five times greater than the cost of the roads, from which it will appear that the individual creation of capital consequent upon the building of railroads is over *ten thousand million dollars*, which is more than one-third part of the whole value of property in the country. The increase in the mileage of railroads in the United States in the year 1869 was more than ten per cent. of the whole length of roads in operation, and the increase per cent. of cost, in consequence of the better manner in which they are now built, was yet greater. It is manifest, therefore, that, apart from the direct value of the work done in that year, the indirect augmentation of capital was more than one thousand million dollars.

Many of the railroads built in this country have not proved directly profitable to stockholders, and their failure to pay profits in many cases has arisen from mismanagement, or from the reckless competion in which the directors of companies have engaged them. In some instances positive dishonesty has robbed stockholders of their proper returns; but there has been exhibited in every department of business, and in all the affairs of social life, so great a disregard for honesty and candid dealing that it cannot be affirmed that those who have managed the affairs of railroad companies have been less faithful to those who have invested their money in them than men in other occupations have shown toward those by whom they have been trusted.

Considering the immense growth of wealth which has been caused by building our railroads, and the increasing activity which is shown by such undertakings, we may form some idea of the pecuniary power and national greatness which will hereafter result from the works which will be constructed. We should not, however, ignore the fact that a constantly increasing number of persons devote themselves to occupations of an unproductive and demoralizing character, and that their waste offsets, to a great extent, the increase of our productive resources.—*The Underwriter.*

—The Southern Atlantic Telegraph Company has completed its line to Gordonsville and Richmond, Virginia, and opened for business at those places. A section of the line between Charleston and Columbia, S. C., is also nearly completed. This line, which is being built by the sea coast route to New Orleans, connects with the Franklin Company at Washington, D. C.

—It is again reported that the Pennsylvania Railroad Company is negotiating for the lease of the Camden & Amboy and the other lines of the "United Companies of New Jersey."

—At an election recently held in Norfolk, Va., to decide whether city aid should be extended to a railroad company, the negroes voted almost solidly with the mass of the white tax-payers against issuing bonds for the purpose.

CHICAGO & NORTHWESTERN R. W.

Comprising the PRINCIPAL RAILROADS from CHICAGO Directly NORTH NORTH-WEST and WEST.

ALL RAIL TO THE PACIFIC OCEAN!

Great California Line.

TRAINS LEAVE WELLS STREET DEPOT AS FOLLOWS:

8:15 A. M. Cedar Rapids Pass | **9:15 P. M.** Night Mail.
10:30 A. M. Pacific Express. | **9:15 P. M.** Rock Island Pass.
10:30 A. M. Rock Island Exp. | **4:00 P. M.** Dixon Passenger.

For Sterling, Rock Island, Fulton, Clinton, Cedar Rapids, Boone, Denison, Missouri Valley Junction, Sioux City, Council Bluffs and Omaha, there connecting with the

UNION PACIFIC R. R.

For Cheyenne, Denver, Ogden, Salt Lake, the White Pine Silver Mines, Sacramento, San Francisco, and all parts of Nebraska, Colorado, New Mexico, Arizona, Wyoming, Montana, Idaho, Utah, Nevada, and the PACIFIC COAST.

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
To OMAHA,.....	23	$20.00	To SACRAMENTO,.	4½	$118.00
" DENVER,.....	52	70.75	" SAN FRANCISCO,	5	118.00

TRAINS ARRIVE:—Night Mail, 7.00 a. m.; Dixon Passenger, 11.10 a. m.; Pacific Express, 3:50 p. m.; Rock Island Express, 3:50 p. m.; Cedar Rapids Passenger, 6:50 p. m.

FREEPORT LINE.

9.00 A. M. & 9.45 P. M. For Belvidere, Rockford, Freeport, Galena, Dunleith, and St. Paul.
4.00 P. M., Rockford Accommodation.
5.30 P. M., Geneva and Elgin Accommodation
6.10 P. M., Lombard Accommodation.
5:50 P. M., Junction Passenger.

TRAINS ARRIVE:—Freeport Passenger, 2:30 a. m., 3:00 p. m.; Rockford Accommodation, 11:10 a. m.; Geneva and Elgin Accommodation, 8:45 a. m.; Junction Passenger, 8:10 a. m.; Lombard Accommodation, 6:50 a. m.

WISCONSIN DIVISION.

☞ Trains leave Depot, cor. West Water and Kinzie Sts., daily, Sundays excepted, as follows:

10.00 A. M. DAY EXPRESS, for Janesville, Monroe, Whitewater, Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Neenah, Appleton, and Green Bay.
3.00 P. M., Janesville Accommodation.
5.00 P. M. NIGHT EXPRESS, for Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Menasha, Appleton, Green Bay, and THE LAKE SUPERIOR COUNTRY.
5.30 P. M., Woodstock Accommodation.
6:20 P. M., Barrington Passenger.

TRAINS ARRIVE:—5:30 a. m., 7:45 a. m., 10:10 a. m., 1:00 p. m. and 7:15 p. m.

MILWAUKEE DIVISION.

MILWAUKEE MAIL,.....		8:00 A. M.
EXPRESS, (ex. Sun.) Waukegan, Kenosha, Racine and Milwaukee,.....	9:45 A. M.	5:00 P. M.
EVANSTON PASSENGER,.....		11:40 A. M.
HIGHLAND PARK PASSENGER,.....		1:15 P. M.
MILWAUKEE ACCOMMODATION, with Sleeping Car attached.....		11:00 P. M.
EVANSTON ACCOMMODATION, (Daily,) from Wisconsin Div. Depot.....		1:30 P. M.
KENOSHA ACCOMMODATION, (Sundays excepted) from Wells St. Depot.....		4:15 P. M.
AFTERNOON PASSENGER, from Milwaukee Div. Depot.....		5:00 P. M.
WAUKEGAN ACCOMMODATION, (except Sundays) from Wells St. Depot.....		5:25 P. M.
WAUKEGAN PASSENGER, (Sundays excepted) from Wells St. Depot.....		6:15 P. M.

TRAINS ARRIVE:—Night Accommodation, with Sleeping Car, 5:00 a. m.; Day Express, 4:10 p. m. Milwaukee Mail, 10:10 a. m.; Afternoon Passenger, 8:00 p. m.; Waukegan Accommodation, 8:25 a. m.; Kenosha Accommodation, 9:10 a.m.; Evanston Accommodations, 1.40 and 4.00 p. m.; Waukegan Passenger, 7:55 a. m.; Highland Park Passenger, 3.45 p. m.

PULLMAN PALACE CARS ON ALL NIGHT TRAINS.

THROUGH TICKETS Can be purchased at all principal Railroad Offices East and South, and in Chicago at the Southeast corner of Lake and Clark Streets, and at the Passenger Stations as above.

H. P. STANWOOD, Gen. Ticket Agt.
GEO. L. DUNLAP, Gen'l Supt.

Western Union Railroad.

CHICAGO & NORTHWESTERN DEPOT, CHICAGO. | MILWAUKEE & CHICAGO DEPOT, MILWAUKEE.

THE DIRECT ROUTE!

CHICAGO, RACINE & MILWAUKEE,

— TO —

Beloit, Savanna, Clinton, Pt. Byron, Davenport, Mineral Point, Madison, Freeport, Fulton, Lyons, Rock Island, Sabula, Galena, Dubuque, Des Moines, Council Bluffs,

OMAHA, SAN FRANCISCO

AND ALL PRINCIPAL POINTS IN

Southern and Central Wisconsin, Northern Illinois, and Central and Northern Iowa.

FRED. WILD, Gen. Ticket Agent.
D. A. OLIN, Gen. Superintendent.

CRERAR, ADAMS & CO.,

MANUFACTURERS AND DEALERS IN

Railroad Supplies!

—AND—

CONTRACTORS' MATERIAL.

11 and 13 Wells Street,

CHICAGO, ILL.

Manufacturers of IMPROVED HEAD-LIGHTS for Locomotives, Hand and Signal Lanterns, Car and Station Lamps, Brass Dome Casings, Dome Mouldings, Cylinder Heads, and Car Trimmings, of Every Description.

Pan-Handle

— AND —

Penn'a Central Route East!

☞ SHORTEST AND QUICKEST ROUTE, VIA COLUMBUS, TO

PITTSBURGH, BALTIMORE, PHILADELPHIA & NEW YORK

On and after Saturday, JULY 10th, 1870, Trains for the East will run as follows:

[DEPOT CORNER CANAL AND KINZIE STS., WEST SIDE.]

8:10 A. M. DAY EXPRESS.

[SUNDAYS EXCEPTED.] Via Richmond. Arriving at

COLUMBUS....	2:35 A. M.	HARRISBURG..	10:35 P. M.	NEW YORK....	6:40 A. M.	WASHINGTON..	5:50 A. M.
PITTSBURGH..	12:00 M.	PHILADELPHIA	3:10 A. M.	BALTIMORE..	2:20 A. M.	BOSTON.....	5:05 P. M.

7:40 P. M. NIGHT EXPRESS.

[SATURDAYS EXCEPTED.] Arriving at:

COLUMBUS..	11:15 A. M.	HARRISBURG..	5:10 A. M	NEW YORK...	12:10 P. M.	WASHINGTON.	1:10 P. M.
PITTSBURGH..	7:05 P. M.	PHILADELPHIA.	9.35 A. M.	BALTIMORE...	9:00 A. M.	BOSTON.....	11:50 P. M.

Palace Day and Sleeping Cars

Run Through to COLUMBUS, and from Columbus to NEW YORK, WITHOUT CHANGE!

ONLY ONE CHANGE TO NEW YORK, PHILADELPHIA, OR BALTIMORE!

CINCINNATI & LOUISVILLE AIR LINE SOUTH.

42 Miles the Shortest Route to Cincinnati,
18 Miles the Shortest Route to Indianapolis and Louisvill .

—FROM ONE TO—

2 Hours the Quickest Route to Cincinnati!

THE SHORTEST AND BEST ROUTE TO

Columbus, Chillicothe, Hamilton, Wheeling, Parkersburg, Evansville, Dayton, Zanesville, Marietta, Lexington, Terre Haute, Nashville,

ALL POINTS IN CENTRAL & SOUTHERN OHIO, & INDIANA, KENTUCKY & VIRGINIA.

— QUICK, DIRECT AND ONLY ALL RAIL ROUTE TO —

New Orleans, Memphis, Mobile, Vicksburg, Charleston, Savannah,

AND ALL POINTS SOUTH.

Cincinnati, Indianapolis and Louisville Trains run as follows:

THROUGH WITHOUT CHANGE OF CARS!

8:10 A. M. (Sundays excepted) Arriving at		7:40 P. M. (Saturdays excepted.) Arriving at	
LOGANSPORT.....	1:15 P. M.	LOGANSPORT.....	1:30 A. M.
KOKOMO.....	2:33 P. M.	KOKOMO.....	2:45 A. M.
CINCINNATI.....	9:30 P. M.	CINCINNATI.....	10:30 A. M.
INDIANAPOLIS.....	5:00 P. M.	INDIANAPOLIS.....	5:40 A. M.
LOUISVILLE.....	11:30 P. M.	LOUISVILLE.....	3:50 P. M.

Lansing Accommodation: Leaves 5:10 P. M. Arrives 8:55 A. M.
Dolton Accommodation: Leaves 10:10 A. M. Arrives 3:25 P. M.

PULLMAN'S PALACE SLEEPING CARS!

Accompany all Night Trains between Chicago and Cincinnati or Indianapolis.

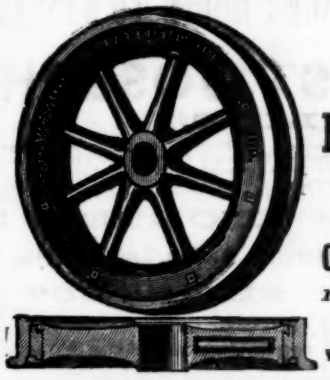
☞ Ask for Tickets via **COLUMBUS** for the East, and via **"The AIR LINE"** for Cincinnati, Indianapolis, Louisville and points South. Tickets for sale and Sleeping Car Berths secured at **95 RANDOLPH STREET, CHICAGO,** and at Principal Ticket Offices in the West and Northwest.

WM. L. O'BRIEN, Gen. Pass. and Ticket Agent, Columbus.
I. S. HODSDON, Northwestern Pass. Agt., Chicago.

D. W. CALDWELL Gen Supt. Columbus.

MOORE
Steel Elastic Car Wheel Co.

OF NEW JERSEY.



Proprietors of

MOORE'S PATENT

FOR THE MANUFACTURE OF

ELASTIC CAR WHEELS.

FOR PASSENGER AND SLEEPING COACHES.

Noiseless, Safe, Durable and Economical.

Also, Manufacturers of

CAR WHEELS OF EVERY DESCRIPTION.

H. W. MOORE, President.
JAS. K. FROTHINGHAM, Secretary.
F. W. BLOODGOOD, Treasurer.

Works, cor. Green and Wayne Sts., JERSEY CITY, N. J.
P. O. Address—Box 129, Jersey City, N. J.

American Compound Telegraph Wire.

More than 3000 Miles now in Operation,

Demonstrating beyond question its superior working capacity, and great ability to withstand the elements. For RAILROAD LINES, connecting a single wire with a large number of Stations, and for long circuits, this wire is peculiarly adapted; the large conducting capacity secured by the copper, with other advantages, rendering such lines fully serviceable during the heaviest rains.

Having a core of steel, a small number of poles only are required, as compared with iron wire construction, thereby preventing much loss of the current from escape and very materially reducing cost of maintenance. OFFICE AMERICAN COMPOUND TELEGRAPH WIRE CO.
234 West 29th Street, New York.

BLISS, TILLOTSON & CO., Western Agents,
247 South Water Street, Chicago.

THE FAVORITE THROUGH PASSENGER ROUTE!

Chicago, Burlington & Quincy

RAILROAD LINE.

3 THROUGH EXPRESS TRAINS DAILY!

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
TO OMAHA, - - -	23	$20.00	TO DENVER, - -	2¼	$68.70
" ST. JOSEPH, - -	21	19.50	" SACRAMENTO, -	4½	118.00
" KANSAS CITY, -	22	20.00	" SAN FRANCISCO,	5	118.00

Trains Leave Chicago from the Great Central Depot, foot of Lake Street, as follows:

BURLINGTON, KEOKUK, COUNCIL BLUFFS & OMAHA LINE.

7:40 A. M. **MAIL AND EXPRESS**, (Except Sunday,) stopping at all stations; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Galena, Dunleith, Dubuque, LaSalle, El Paso, Bloomington, &c.

10:45 A. M. **PACIFIC FAST LINE**, (Except Sunday,) stopping at Riverside, Hinsdale, Aurora, Leland, Mendota, Princeton, Buda, Kewanee, Galva, Galesburg, and all Stations West and South of Galesburg.

☞ An ELEGANT DAY COACH and a PULLMAN PALACE DRAWING ROOM CAR is attached to this train daily from Chicago

TO COUNCIL BLUFFS & OMAHA WITHOUT CHANGE!

5.00 P. M. **EVENING EXPRESS**, (Daily, except Sunday), in direct connection with the celebrated New York and Chicago Lightning Express Trains of all Eastern Lines, for Burlington, Ottumwa, Des Moines, Nebraska City, Council Bluffs, Omaha, and all points West. **Pullman Drawing-Room Sleeping Car** attached to this Train daily from **Chicago to Ottumwa without change!**

11:30 P. M. **NIGHT EXPRESS**, (Daily, except Saturday,) stopping at all principal Stations between Chicago and Burlington. ELEGANT DAY COACHES, and a **PULLMAN PALACE SLEEPING CAR** are attached to this train from **Chicago to Burlington, without change!** This is the only Route between

CHICAGO, COUNCIL BLUFFS & OMAHA,

— RUNNING THE CELEBRATED —

Pullman Palace Dining Cars!

49 MILES THE SHORTEST ROUTE BETWEEN

Chicago & Keokuk,

And the Only Route Without Ferrying the Mississippi River!

QUINCY, ST. JOSEPH, LEAVENW'TH & KANSAS CITY LINE.

10:45 A. M. **PACIFIC EXPRESS**, (Daily, except Sunday,) with an Elegant Day Coach and one of PULLMAN'S PALACE SLEEPING CARS attached, running through from Chicago to KANSAS CITY, **Without Change!**

5:00 P. M. **EVENING EXPRESS**, (Daily, except Sunday,) with **Pullman Palace Drawing Room Sleeping Car** attached, running through from Chicago to QUINCY, Without Change!

11:30 P. M. **NIGHT EXPRESS** (Daily, except Saturday,) with **Pullman Palace Sleeping Car** attached from Chicago to GALESBURG: Palace Day Coaches from Chicago to QUINCY, **Without Change!**

64 MILES THE SHORTEST AND ONLY ROUTE BETWEEN

Chicago and Kansas City!

WITHOUT CHANGE OF CARS OR FERRY.

115 MILES The Shortest Route bet. Chicago & St. Joseph.

THE SHORTEST, BEST AND QUICKEST ROUTE BETWEEN CHICAGO AND

Atchison, Weston, Leavenworth, Lawrence,

AND ALL POINTS ON THE KANSAS PACIFIC R'Y.

Local Trains Leave { RIVERSIDE & HINSDALE ACCOMMODATION, 7:00 A. M. 1:30 & 6:15 P. M. / MENDOTA PASSENGER ..... 4:15 P. M. / AURORA PASSENGER ..... 5:30 P. M.

Trains Arrive:—Mail and Express, 3:45 p. m.; Atlantic Exp., 4:15 p. m, except Sunday; Night Exp, 9:05 a. m., except Monday; Mendota Passenger, 10:00 a. m.; Aurora Passenger, 8:15 a. m.; Quincy Passenger 7:30 P. M.; Riverside and Hinsdale Accommodation, 6:50 and 9 a. m. and 5:30 p. m., except Sunday.

Ask for Tickets via Chicago, Burlington & Quincy Railroad, which can be obtained at all principal offices of connecting roads, and at Company's office in Great Central Depot, Chicago, at as low rates as by any other route.

ROB'T HARRIS, Gen'l Superintendent, CHICAGO.
SAM'L POWELL, Gen'l Ticket Agent, CHICAGO.
E. A. PARKER, Gen. West. Pass. Agt., CHICAGO

THE GREAT THROUGH PASSENGER ROUTE TO KANSAS

IS VIA THE OLD RELIABLE

HANNIBAL & ST. JOSEPH

SHORT LINE.

Crossing the Mississippi at Quincy and the Missouri at Kansas City on New Iron Bridges; running Three Daily Express Trains, Through Cars and Pullman Sleeping Palaces from Chicago & Quincy to St. Joseph & Kansas City.

The Advantages gained by this Line over any other Route from Chicago, are:

115 MILES THE SHORTEST!

To St. Joseph, Atchison, Hiawatha, Waterville, Weston, Leavenworth,

64 MILES THE SHORTEST!

To Kansas City, Fort Scott, Lawrence, Ottawa,

Garnett, Iola, Humboldt, Topeka, Burlingame, Emporia, Manhattan, Fort Riley, Junction City, Salina, Ellsworth, Hays, Sheridan, Olathe, Paola, Cherokee Neutral Lands, Baxter Springs, Santa Fe, New Mexico, and all Points on the KANSAS PACIFIC, and MISSOURI RIVER, FT. SCOTT & GULF R. R's, with which we connect at Kansas City Union Depot.

THIS BEING THE SHORTEST LINE AND QUICKEST, is consequently the cheapest; and no one that is posted thinks of taking any other Route from Chicago to reach principal points in

Missouri, Kansas, Indian Territory, or New Mexico.

DAILY OVERLAND STAGES from west end Kansas Pacific Railway, for Pueblo, Santa Fe, Denver, and points in Colorado and New Mexico.

This is also a most desirable Route, via St. Joseph, to Brownsville, Nebraska City, Council Bluffs, and Omaha, connecting with the Union Pacific Railroad for Cheyenne, Denver, Salt Lake, Sacramento, San Francisco, and the Pacific coast.

Through Tickets for Sale at all Ticket Offices. Baggage, Checked Through, and Omnibus Transfers and Ferriage avoided.

P. B. GROAT, Gen. Ticket Agent. HANNIBAL, MO.
GEO. H. NETTLETON, Gen. Supt. HANNIBAL, MO.

Old, Reliable, Air-Line Route!

CHICAGO, ALTON & ST. LOUIS R. R.

SHORTEST, QUICKEST AND ONLY DIRECT ROAD TO

Bloomington, Springfield, Jacksonville, Alton,

— AND —

ST. LOUIS!

WITHOUT CHANGE OF CARS.

THE ONLY ROAD MAKING IMMEDIATE CONNECTIONS AT ST. LOUIS, WITH MORNING AND EVENING TRAINS

—FOR—

ATCHISON, LEAVENWORTH, KANSAS CITY,

Lawrence, Topeka, Memphis, New Orleans,

And All Points South and Southwest.

☞ TRAINS leave Chicago from the West-side Union Depot, near Madison Street Bridge. ☜

EXPRESS MAIL, [Except Sundays]	8:10 A. M.
LIGHTNING EXPRESS, [Except Saturdays and Sundays]	9:50 P. M.
NIGHT EXPRESS, [Daily]	6:00 P. M.
JOLIET ACCOMMODATION, [Except Sundays]	4:40 P. M.
JACKSONVILLE EXPRESS, [Daily]	6:00 P. M.

Trains arrive at Chicago at 8.00 P. M., 8.30 A. M. and 6:00 A. M. Joliet Accom., 9.40 A. M.

This is the ONLY LINE Between CHICAGO & ST. LOUIS RUNNING

Pullman's Palace Sleeping and Celebrated Dining Cars!

BAGGAGE CHECKED THROUGH.

Through Tickets can be had at the Company's office, No. 55 Dearborn street, Chicago, or at the Depot, corner of West Madison and Canal streets, and at all principal Ticket Offices in the United States and Canada. Rates of Fare and Freights as low as by any other Route.

A. NEWMAN, Gen. Pass. Agent. **J. C. McMULLIN, Gen. Supt.**

North Missouri R. R.

PASSENGERS FOR

KANSAS AND THE WEST,

ARE REMINDED THAT

THE NORTH MISSOURI R. R.

— IS —

11 MILES SHORTER than any other Route!

BETWEEN

St. Louis and Kansas City.

15 Miles Shorter between ST. LOUIS and LEAVENWORTH

— AND —

49 MILES SHORTER TO ST. JOSEPH!

THAN ANY OTHER LINE OUT OF ST. LOUIS.

☞ **Three Through Express Trains Daily!** ☜

Pullman's Celebrated Palace Sleeping Cars on all Night Trains!

☞ **FOR TICKETS,** apply at all Railroad Ticket Offices, and see that you get your Tickets via St. Louis and North Missouri Railroad.

C. N. PRATT, Gen. Eastern Agt., 111 Dearborn-st. CHICAGO.
S. H. KNIGHT, Gen. Superintendent, ST. LOUIS.

JAS. CHARLTON, Gen. Pass. and Ticket Agt., St. Louis.

Pacific Railroad of Missouri.

THE MOST DIRECT AND RELIABLE ROUTE FROM ST. LOUIS THROUGH TO

KANSAS CITY, LEAVENWORTH & ATCHISON,

☞ WITHOUT CHANGE OF CARS! ☜

Close Connections at KANSAS CITY with Missouri Valley, Missouri River, Ft. Scott & Gulf, and Kansas Pacific R'ys, for Weston, St. Joseph, Junction City, Fort Scott, Lawrence, Topeka, Sheridan, Denver, Fort Union, Santa Fe, and

ALL POINTS WEST!

☞ At SEDALIA, WARRENSBURG and PLEASANT HILL, with Stage Lines for Warsaw, Quincy, Bolivar, Springfield, Clinton, Osceola, Lamar, Carthage, Granby, Neosho, Baxter Springs, Fort Gibson, Fort Smith, Van Buren, Fayetteville, Bentonville.

PALACE SLEEPING CARS on all NIGHT TRAINS.

Baggage Checked Through Free!

THROUGH TICKETS for sale at all the Principal Railroad Offices in the United States and Canadas. **Be Sure and Get your Tickets over the PACIFIC R. R. OF MISSOURI.**

W. B. HALE, Gen. Pass. and Ticket Agt.
THOS. McKISSOCK, General Superintendent.